3200-XS
Sub-Bottom Profiling System

User's Manual

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Warning—Read This First!

All personnel involved with the installation, operation or maintenance of the equipment described in this manual should read and understand the warnings and recommendations provided below.

Static Sensitive Devices

This equipment contains devices that are extremely sensitive to static electrical charges. Therefore extreme care should be taken when handling them as static electricity may be present on the body and clothing. Normal handling precautions involve the use of anti-static protection materials and grounding straps for personnel.

Radiation

This equipment generates, uses and can radiate radio frequency energy. Therefore if the equipment is not installed properly, it may cause interference with radio communications. The equipment has not been tested for compliance with the appropriate FCC rules designed to provide reasonable protection against such interference when operated in a commercial environment. Therefore when operating the equipment in a residential area, the user may be required to take whatever measures are needed and incur any expenses necessary to eliminate interference; it is the user's responsibility to verify that the system complies with the applicable FCC emission limits.

High Voltages

High voltages are present in the tow vehicle, the power amplifier and the topside processor. Always use caution when removing the electronics from these devices.

Improper Line Voltage

Operation with improper line voltage may cause serious damage to the equipment. Always ensure that the proper line voltage is used.

Preface

We, the employees at EdgeTech, would like to thank you for purchasing a 3200-XS Sub-Bottom Profiling System. At EdgeTech it is our policy to provide high quality, cost effective products and support services that meet or exceed your requirements, to deliver them on time and to continuously look for ways to improve them. We take pride in the products we manufacture and want you to be entirely satisfied with your equipment. The information in this manual will get you started. It tells you what you need to set up, to operate and to maintain the 3200-XS Sub-Bottom Profiling System.

Purpose of this Manual

The purpose of this manual is to provide the user with information on the setup, operation, care, and maintenance of the EdgeTech 3200-XS Sub-Bottom Profiling System. For general information on sub-bottom profiling, refer to papers published in the Journal of the Acoustical Society of America, Offshore Technology Conference, IEEE Journal of Oceanic Engineering by L.R. LeBlanc and S.G. Schock. Although this manual encompasses the latest operational features of the 3200-XS Sub-Bottom Profiling System, some features of the system may be periodically upgraded. Therefore the information in this manual is subject to change and should be used for reference only.

This manual is divided into the following four sections and two appendices:

Section 1: Overview. Provides some background information about EdgeTech, discusses the advantages of EdgeTech's Full Spectrum chirp technology, and describes the main components of the 3200-XS Sub-Bottom Profiling System.

Section 2: Specifications. Lists the electrical, mechanical and environmental specifications for the main components of the 3200-XS Sub-Bottom Profiling System.

Section 3: Setup and Test. Provides instructions on how to set up and test the 3200-XS Sub-Bottom Profiling System and how to deploy and tow the tow vehicle.

Section 4: Maintenance and Troubleshooting. Provides some maintenance recommendations and instructions on how to disassemble and reassemble a tow vehicle. Included also are some troubleshooting procedures and connector pinout and wiring information.

Appendix A: Printer Connections. Lists many of the printers that can be used with the 3200-XS Sub-Bottom Profiling System and provides the setup requirements and general specifications for a few of these printers that will provide the best results.

Appendix B: Frequently Asked Questions. Provides some frequently asked questions from EdgeTech customers about the 3200-XS Sub-Bottom Profiling System.

Warnings, Cautions and Notes

Where applicable, warnings, cautions and notes are provided in this manual as follows:

WARNING!

Identifies a potential hazard that could cause personal injury or death to yourself or to others.

CAUTION!

Identifies a potential hazard that could be damaging to equipment or could result in the loss of data.

NOTE: **Recommendations or general information that is particular to the material being presented or a referral to another part of this manual or to another manual.**

Liability

EdgeTech has made every effort to document in this manual the 3200-XS Sub-Bottom Profiling System accurately and completely. However, EdgeTech assumes no liability for errors or for any damages that result from the use of this manual or the equipment it documents. EdgeTech reserves the right to upgrade features of this equipment and to make changes to this manual without notice at any time.

Warranty

All equipment manufactured by EdgeTech is warranted against defective components and workmanship for a period of one year after shipment. Warranty repair will be done by EdgeTech free of charge. Shipping costs are to be borne by the customer. Malfunction due to improper use is not covered in the warranty and EdgeTech disclaims any liability for consequential damage resulting from defects in the performance of the equipment. No product is warranted as being fit for a particular purpose and there is no warranty of merchantability. This warranty applies only if:

i. The items are used solely under the operating conditions and in the manner recommended in Seller's instruction manual, specifications, or other literature.

ii. The items have not been misused or abused in any manner or repairs attempted thereon.

iii. Written notice of the failure within the warranty period is forwarded to Seller and the directions received for properly identifying items returned under warranty are followed.

iv. The return notice authorizes Seller to examine and disassemble returned products to the extent Seller deems necessary to ascertain the cause for failure.

The warranties expressed herein are exclusive. There are no other warranties, either expressed or implied, beyond those set forth herein, and Seller does not assume any other obligation or liability in connection with the sale or use of said products. Any product or service repaired under this warranty shall be warranted for the remaining portion of the original warranty period only.

Equipment not manufactured by EdgeTech is supported only to the extent of the original manufacturer's warranties.

Software Service Agreement

EdgeTech provides software services free of charge for one year following the purchase of an EdgeTech system. A Software Service Agreement (SSA), which is available for an annual fee, covers these services after the first year. The services are listed below.

The SSA does not address customer specified modifications or enhancements. These services may be ordered separately. Furthermore, EdgeTech software upgrades are meant for the sole use of EdgeTech customers that have purchased a system within a year or have an existing SSA. Any reproduction of EdgeTech supplied software or file sharing is strictly prohibited.

Software Updates and Enhancements

EdgeTech customers automatically receive regular new software releases with all modifications and enhancements along with user's manual changes. New software releases consist of the following:

- Software enhancements that are not on the price list
- Software fixes and changes
- Product integration
- Documentation updates to on-line help
- Tests for compatibility with other modules

Software patches consist of software that has undergone the following:

- Minor software enhancements
- Software fixes and changes

Software Performance Report

EdgeTech customers may submit reports using a Software Performance Report (SPR) form. SPR forms are available from EdgeTech. This report may be related to a problem or to an inquiry, or it may be a specific request for a software enhancement. EdgeTech will attend to the SPR at a priority level appropriate to the seriousness of the problem and to the availability of a work-around.

Software Telephone, Facsimile and E-mail Support

The SSA entitles EdgeTech customers to contact EdgeTech Customer Service by telephone, facsimile or e-mail to report a difficulty, to discuss a problem or to receive advice on the best way to perform a task. When contacted, EdgeTech Customer Service will do the following:

- Respond within 24 hours
- Immediately attend to serious problems affecting operations
- Attempt to find an immediate work-around

Software Service Agreement Fee

The SSA covers one year and is renewable upon expiration. For the SSA annual fee, please contact EdgeTech directly. For contact information refer to Customer Service on page x.

Returned Material Authorization

Prior to returning any equipment to EdgeTech a Returned Material Authorization (RMA) number must be obtained. The RMA will help us identify your equipment when it arrives at our receiving dock and track the equipment while it is at our facility. The material should be shipped to the address provided in Customer Service on page x. Please refer to the RMA number on all documents and correspondence as well.

All returned material must be shipped prepaid. Freight collect shipments will not be accepted.

The following steps apply only to material being returned from outside the Continental United States. Follow them carefully to prevent delays and additional costs.

1. All shipments must be accompanied by three copies of your proforma invoice, showing the value of the material and the reason for its return, if the reason is for repair, it must be clearly stated in order to come through customs faster and without duties being charged. Whenever possible, please send copies of original export shipping documents with the consignment.
2. If the value of the equipment is over $1000, the following Shipper's oath must be sent with the invoice. This oath can be typed on the invoice, or on a separate letterhead.

   "I, _____, declare that the articles herein specified are the growth, produce, or manufacture of the United States; that they were exported from the United States from the port of _____, on or about _____; that they are returned without having been advanced in value or improved in condition by any process of manufacture or any other means; and that no drawback, or allowance has been paid or admitted hereof."

   Signed _____
3. If there is more than one item per consignment, a packing list must accompany the shipment. It is acceptable to combine the proforma invoice and packing list as long as the contents of each carton are clearly numbered and identified on the invoice.
4. Small items can be shipped prepaid directly to EdgeTech by FedEx, DHL, UPS, Airborne, etc.
5. If the equipment is the property of EdgeTech (formerly EG&G Marine Instruments Division) please insure for full value.
6. Fax one invoice, packing list, and a copy of the airway bill to EdgeTech upon shipment.

Customer Service

Customer service personnel at EdgeTech are always eager to hear from users of our products. Your feedback is welcome and is a valuable source of information which we use to continually improve these products. Therefore we encourage you to contact customer service to offer any suggestions or to request technical support. They can be reached as follows:

E-mail: service@edgetech.com

Mail: 4 Little Brook Road
West Wareham, MA 02576

Telephone: (508) 291-0057, Ext 712

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For more information please go to www.edgetech.com.

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SECTION 1: Overview

The 3200-XS Sub-Bottom Profiling System is a high resolution wideband frequency modulated (FM) sub-bottom profiler that uses EdgeTech's proprietary Full Spectrum chirp technology to generate cross sectional images of the seabed and collect digital normal incidence reflection data over many frequency ranges. The 3200-XS transmits an FM pulse (also called a "chirp pulse") that is linearly swept over a full spectrum frequency range. The reflections measured by the system are displayed as shades of gray or color on a computer monitor and may be printed on a continuous feed thermal printer. Data are stored in real time onto a large capacity hard drive and can be archived to a DVD.

1.1 Company Background

EdgeTech (formerly EG&G Marine Instruments) traces its history in underwater data acquisition and processing back to 1966. EdgeTech has designed, developed and manufactured products, instruments and systems for the acquisition of underwater data, including marine, estuarine and coastal applications for over 35 years. It has responded to the needs of the scientific, Naval and offshore communities by providing equipment, such as sub-bottom profilers, side scan sonar, acoustic releases, current meters, and positioning systems that have become standards in the industry. Equally as significant is the company's ability to anticipate and respond to future needs through an active research and development program. Current efforts are focused on the application of cutting edge chirp, DSP and acoustic technology.

1.2 Advantages of Full Spectrum Chirp Technology

EdgeTech's Full Spectrum chirp technology has several distinct advantages over conventional sub-bottom profiling systems. These benefits include use of separate acoustic projectors and receivers to enable simultaneous transmission and reception of acoustic signals, high repeatability of the transmitted signals to enable sediment classification, high signal-to-noise ratio (SNR) for improved acoustic imagery, high resolution for measurement of fine sediment layering, additional processing gain for energy efficiency, Gaussian shaped amplitude spectrum of the outgoing pulse to preserve resolution with sediment penetration, and reduction of side lobes for minimal destructive signal scattering caused by the sediment when profiling near the bottom.

1.2.1 Separate Acoustic Projectors and Receivers

The 3200-XS Sub-Bottom Profiling System uses acoustic projectors and acoustic receivers mounted in a towed vehicle to transmit and receive acoustic FM pulse signals. The projectors are wide band piston type transducers, and the receivers are hydrophone arrays composed of lead zirconate titanate (PZT) crystals. The transducers are mounted in the forward section of the tow vehicle, and the hydrophone arrays, which are designed for profiling at ship speeds up to seven knots, are mounted aft. The use of separate transmitting transducers and receiving hydrophone arrays preserves linearity and allows the simultaneous transmission and reception of the acoustic signals. The transducers and hydrophone arrays are mounted beneath acoustic baffles which minimize direct path, tow vehicle and surface reflections. A preamplifier in the tow vehicle amplifies and drives the received signals through a tow cable to the surface.

1.2.2 High Repeatability

The FM pulses are generated by a digital-to-analog (D/A) converter with a wide dynamic range and a transmitter with linear components. Therefore the energy, amplitude and phase characteristics of the acoustic pulses can be precisely controlled. This precision produces high repeatability and signal definition which is required for sediment classification. The frequency range of operation is determined by the acoustic characteristics of the transmitter transducers and receiving hydrophone arrays mounted on the tow vehicle. Each tow vehicle can transmit acoustic pulses with different center frequencies and bandwidths. The selection of this frequency is made by the operator while profiling to achieve the best imagery, and the tow vehicle is selected based on the sub-bottom conditions at the survey site and the type of sub-bottom features that need to be imaged. EdgeTech technical support can provide assistance in selecting the best tow vehicle for your application.

1.2.3 High Signal-to-Noise Ratio

Full Spectrum chirp technology does not use a conventional matched filter—the correlation filter that is widely used to compress FM signals—to process wide band signals. Rather it uses proprietary amplitude and phase weighting functions for the transmitted pulse and a pulse compression filter that maximizes the SNR of the acoustic images over a wide band of operating frequencies. These functions provide a significant SNR improvement in the acoustic image over other pulse and chirp sonars with band limited components that are limited in dynamic range.

1.2.4 High Resolution

Signals received at the surface from the hydrophone arrays in the tow vehicle pass through a software controlled programmable gain amplifier before being digitized with a 16-bit analog-to-digital (A/D) converter at a sampling rate of 20, 25, 40, or 50 kHz The FM pulse is then compressed using a digital compression filter. This correlation process is implemented in real time with forward and inverse Fast Fourier Transforms. The compressed pulse has a time duration approximately equal to the inverse of the bandwidth of the FM pulse which results in a high temporal resolution. This high resolution enables the measurement of fine layering in the sediment, an important factor in sediment classification because it provides a more realistic picture of the true geologic variability of the sea floor and an accurate determination of the depositional processes.

1.2.5 Additional Processing Gain

In addition to the resolution improvement, correlation processing achieves a signal processing gain over the background noise. This gain is approximately ten times the log of the time-bandwidth product. This improvement is due to the signal having a time duration longer than the inverse of the bandwidth, thus increasing signal energy without increasing the power of the outgoing pulse. To equal the typical performance of the full spectrum sonar pulse, conventional pulse sonar would have to operate at a peak pulse power of 100 times greater than a full spectrum pulse with a time-bandwidth product of 100.

1.2.6 Gaussian Shaped Amplitude Spectrum Outgoing Pulse

Another important feature of Full Spectrum chirp technology is that the signal processing optimizes the performance of the system. The sonar contains many components, each with a unique dynamic range and linearity characteristic which are frequency dependent. In addition to this characteristic, the amplitude spectrum of the outgoing pulse is chosen to be approximately Gaussian in shape to limit the side lobe level and temporal resolution losses due to attenuation. As a wavelet with a Gaussian shaped spectrum is attenuated by the sediment, energy is lost but its bandwidth is nearly preserved. Therefore even after being attenuated by sand, the acoustic pulse has approximately the same resolution as an unattenuated pulse.

1.2.7 Reduction of Side Lobes

Use of Full Spectrum chirp technology reduces the side lobes in the effective transducer aperture. The wide bandwidth of the sweep frequency has the effect of smearing the side lobes of the transducer and thus achieving a beam pattern with virtually no side lobes. The effective spatial beam width obtained after processing a full spectrum 2–10 kHz signal, for example is 20 degrees measured at the -3db points.

1.3 Full Spectrum Chirp Technology Applications

Applications for the Full Spectrum Chirp Technology used in the 3200-XS Sub-Bottom Profiling System are many and include the following:

- EEZ resource development
- Imaging fluidized mud to a resolution of 8 cm
- Sediment classification
- Buried pipeline and cable location and routing
- Dredging studies for inlets
- Scour/erosion surveys in rivers and streams
- Marine geotechnical surveys
- Bridge erosion surveys
- Hazardous waste target location
- Geological surveys
- Archeological surveys
- Hazard surveys
- Mining and dredging surveys
- Bridge and shoreline scour surveys
- Imaging biologics in water column
- Mapping clam populations
- Beach re-nourishment
- Military and offshore oil applications
- Full ocean depth sub-bottom imaging (hull mount systems)
- Environmental site investigations

1.4 Main System Components

The 3200-XS Sub-Bottom Profiling System is composed of three main components: a Deck Unit; an SB-424, SB-216S or SB-512i Tow Vehicle; and a 75-Meter Kevlar Reinforced Tow Cable.

1.4.1 Deck Unit

The Deck Unit is shown in Figure 1-1 and consists of a 3200-XS Topside Processor and a 2-kW Power Amplifier mounted in a portable 19-inch rack type enclosure and shipped in a heavy duty reusable transport case. The processor and the amplifier can also be removed and mounted in any standard 19-inch rack. The processor includes a Mother board and a Sonar Interface board (Tiger board) as shown in Figure 1-2. The Tiger board plugs into the Mother board PCI slot. It also includes an LCD monitor, a DVD R/W drive, a 3-5-inch floppy drive, a keyboard, and a mouse.The Tiger board stores the transmit waveform and the

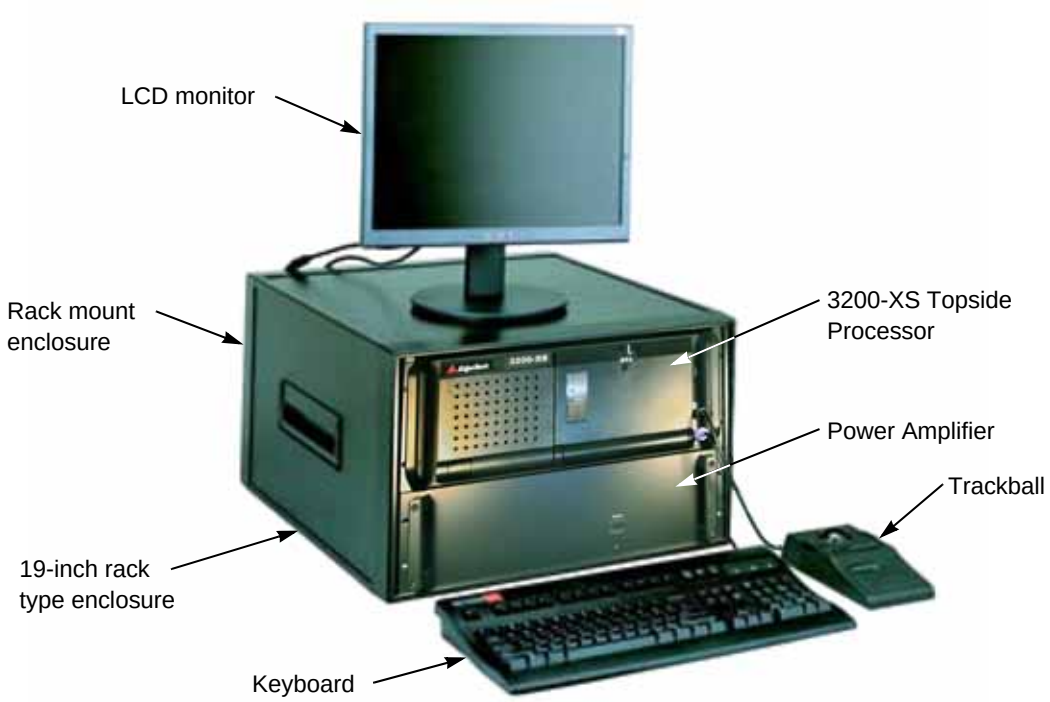


Figure 1-1: Deck Unit

correlation filter as well as performs correlation processing and spherical range correction. At periodic intervals the Tiger board sends the transmit waveform to a 16 bit D/A converter which generates an analog pilot signal that is amplified by the Power Amplifier to drive the transducer in the tow vehicle. The acoustic returns from the sea floor are received by the hydrophone arrays in the tow vehicle and then amplified by a preamplifier which is also

Figure 1-2: Tiger and Mother Boards inside 3200-XS Topside Processor

mounted in the tow vehicle. The output of the preamplifier connects through the tow cable to a digitally controlled amplifier on the Tiger board and is sampled by a 16-bit A/D converter. The Tiger board also performs the correlation processing, corrects for spherical spreading and transfers the data to the Mother board. For additional information on the Tiger board, refer to “Tiger Board Description” on page 1-9.

The Deck Unit also includes the EdgeTech DISCOVER 3200SB software preinstalled on the 3200-XS Topside Processor. DISCOVER 3200SB is a data acquisition and processing program designed exclusively for EdgeTech Full Spectrum chirp sonar systems. The program, which runs on the Microsoft Windows XP operating system, verifies that the sonar system is working properly prior to deployment by providing data displays, diagnostics, data recording, playback, and printer outputs. The program supports sonar data inputs and sonar command and control outputs over a TCP/IP connection, a NMEA navigation input through an RS-232 serial port, and a printer connection through a parallel port. For compatibility with other EdgeTech products, DISCOVER 3200SB interfaces with a second software program, SONAR.EXE which runs in the background and controls the sub-bottom sonar system, performs a self test on startup, and generates reports and diagnostic information. It is automatically launched when the processor is switched on. SONAR.EXE interfaces with the Tiger board to generate and transmit chirp pulses.

1.4.2 SB-424, SB-216S and SB-512i Tow Vehicles

The SB-424, SB-216S and SB-512i Tow Vehicles are each designed to operate over a specific frequency range, and as lower operating frequencies generally require longer hydrophone arrays and larger transducers, they differ primarily in size and weight. The SB-424 Tow Vehicle, which is the smallest of the three, operates over a frequency range of 4–24 kHz, followed by the SB-216S at 2–16 kHz and then the SB-512i at 0.500–12 kHz. All three tow vehicles are shown in Figure 1-4. Each is hydrodynamically stable with the transducers and hydrophone arrays mounted under an acoustic baffle to reject downward traveling multiple echoes. These components, along with "spider" cable harnesses and a preamplifier are enclosed in a two-piece fiberglass shell that is fitted with stabilizing fins and lead ballast. A hinged U-framed tow bridle is used for towing, and the tow point location can be adjusted to accommodate different towing speeds and depths. The tow vehicles are each shipped in a wooden crate.

1.4.3 75-Meter Kevlar Reinforced Tow Cable

The tow cable is a 75-Meter Kevlar Reinforced Cable that includes three twisted shielded wire pairs. This cable, which is shown in Figure 1-3 and is available separately, is used to connect to and tow the SB-424, SB-216S and SB-512i Tow Vehicles. However, because of the weight and drag exhibited by the larger SB-512i Tow Vehicle, a separate steel cable is recommended for towing this tow vehicle. The steel cable can be attached to the tow cable. In addition, to increase the life of the tow cable, which has a tensile strength of 650 pounds, a separate steel cable can also be used with the SB-424 and SB-216S Tow Vehicles. The tow cable includes a cable grip for attaching to the tow bridle of the tow vehicle and is shipped in a wooden crate with the tow vehicle.

Figure 1-3: 75-Meter Kevlar Reinforced Tow Cable

SB-424 Tow Vehicle

SB-216S Tow Vehicle

SB-512i Tow Vehicle

Figure 1-4: SB-424, SB-216S and SB-512i Tow Vehicles

1.5 Tiger Board Description

The Sonar Interface board (Tiger board) is the real-time controller for sonar processing. It includes transmit waveform tables and multiple channels of 10-bit high speed digital-to-analog (D/A) converters, support for external and internal triggers, and support for multiple sonar analog-to-digital (A/D) converters. It was designed to support a combined sonar system (with both sub-bottom as well as multi-frequency side-scan capability), or to be used single channel as a basic sub-bottom controller. At periodic intervals it generates the transmit waveform(s), and it continuously buffers ADC data.

The Tiger board represents a new generation of re-engineered and optimized sonar electronics. It is designed to address a broad spectrum of sonar applications from a common and well tested base of components. Among the features of this generation are lower power consumption, higher speeds, smaller form factors, and high analog sensitivity-to-minimum noise electronics for improved operating ranges. The Tiger board is actually composed of a set of three board as shown in Figure 1-5: a Carrier board, an Acquisition board and a Sonar/IDE board. All three boards are connected electrically and mechanically as a single assembly that plugs into the Mother board PCI slot.

1.5.1 Carrier Board

This board has the same physical size as an industry standard full slot PCI card. There are two BNC connectors, TRIGGER IN and TRIGGER OUT, and female connectors on either side for mating with the other two boards in the board set. An onboard DC/DC converter provides +12 VDC to the preamplifier in the tow vehicle.

1.5.2 Acquisition Board

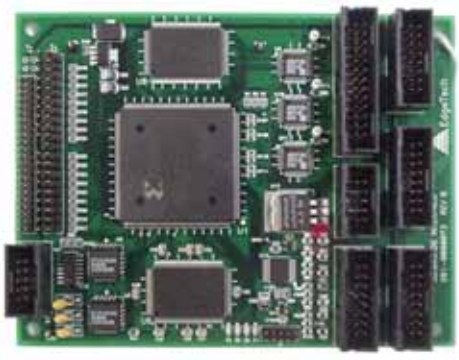
The Acquisition board contains band pass filtering and up to eight 24-bit A/D converters, where only two channels are used. The first channel is for the received acoustic data from the preamplifier, and the second channel is used for power-up diagnostics.

1.5.3 Sonar/IDE Board

The sonar/IDE board is composed of two RAM memories, an acquisition memory and a chirp memory, and six 10-bit D/A converters for generating transmit waveforms. The transmit ping rate and sampling clock are generated from this board. The IDE portion of the board provides the interfacing circuitry required to communicate between the Mother board and the Tiger board.

Carrier board

Acquisition board



Sonar IDE board

Figure 1-5: Tiger Board Set

SECTION 2: Specifications

The specifications for the 3200-XS Sub-Bottom Profiling System include electrical, mechanical and environmental characteristics for the Deck Unit, the SB-424, SB-216S and SB-512i Tow Vehicles, and the 75-Meter Kevlar Reinforced Tow Cable.

NOTE: **All specifications are subject to change without notice.**

2.1 Deck Unit

The Deck Unit includes the 3200-XS Topside Processor and the Power Amplifier in a 19-inch rack type enclosure.

CAUTION!

The Deck Unit is application specific. It should not be used for purposes other than that for which it was intended.

2.1.1 Deck Unit General

The general specifications for the Deck Unit are shown in Table 2-1.

Table 2-1: Deck Unit General Specifications

Operating temperature:	0–40°C (32°–104°F)
Operating humidity:	5–95% relative
Vibration:	Normal ship environment
Weight:	46 kg (102 lb)
Enclosure type:	Portable aluminum 19-inch rack type enclosure
Enclosure size:	50 cm (19.5 in.) W 33 cm (13.0 in.) H 60 cm (23.5 in.) D
Shipping container type:	Sealed high impact polyurethane case
Shipping container size:	71 cm (28.0 in.) W 79 cm (31.0 in.) H 109 cm (43.0 in.) D
Shipping weight:	89 kg (195 lb)

2.1.2 3200-XS Topside Processor

The specifications for the 3200-XS Topside Processor are shown in Table 2-2.

Table 2-2: 3200-XS Topside Processor Specifications

Mother board:	Intel Pentium 4
Sonar Interface:	Sonar Interface board (Tiger board) composed of Carrier board, Acquisition board and Sonar/IDE board set
Memory:	512 MB RAM
Hard drives:	80 GB minimum (operating system) 160 GB minimum (data recording)
DVD-R/W drive:	10x4x32 minimum speed
Operating system:	Windows XP
Application software:	DISCOVER 3200SB
Display:	High resolution 21-inch flat panel LCD monitor
Keyboard:	High impact industrial
Trackball:	High impact industrial
I/O ports:	(1) Ethernet (2) RS-232 (3) USB (1) Parallel
Analog input:	16 bit resolution, 200 kHz max sampling rate
Analog output:	16 bit resolution, 200 kHz max sampling rate
Pulse type:	Full Spectrum Chirp FM
Pulse length:	5–100 ms, depending tow vehicle and application
Bandwidth:	0.5–12 kHz, depending tow vehicle and application
Trigger in:	TTL negative edge triggered
Trigger out:	TTL negative edge triggered, 5 ms long pulse minimum
Sampling rate:	20, 25, 40, or 50 kHz, depending on the transmit upper frequency
Acoustic power:	212 dB re 1 µPa @ 1 meter peak (approx), at center frequency
Input voltage:	120–220 VAC, 50/60 Hz, auto sense

2.1.3 Power Amplifier

The specifications for the Power Amplifier are shown in Table 2-3.

Table 2-3: Power Amplifier Specifications

Number of channels:	2
Gain:	33 dB/channel
Output power:	2000 W peak
Input voltage:	120–220 VAC, 50/60 Hz, manually selectable

2.2 SB-424, SB-216S and SB-512i Tow Vehicles

The general specifications for the SB-424, SB-216S and SB-512i Tow Vehicles are shown in Table 2-4.

Table 2-4: Tow Vehicle Specifications

	SB-424	SB-216S	SB-512i
Frequency range:	4–24 kHz	2–16 kHz	0.5–12 kHz
Pulse type:	FM	FM	FM & WB (wide band)
Pulse bandwidth/pulse length:	4-24 kHz/10 ms 4–20 kHz/10 ms 4–16 kHz/10 ms	2-15 kHz/20 ms 2–12 kHz/20 ms 2–10 kHz/20 ms	0.5–8.0 kHz/5 ms FM 0.5–2.7 kHz/40 ms WB 0.5–6.0 kHz/20 ms WB 0.5–4.5 kHz/50 ms FM 0.5–6.0 kHz/9 ms FM 0.5–6.0 kHz/18 ms FM 0.5–7.2 kHz/30 ms FM 0.7–12.0 kHz/20 ms FM 2.0–12.0 kHz/20 ms FM
Calibration:	Gaussian shaped pulse spectrum	Gaussian shaped pulse spectrum	Gaussian and rectangular shaped pulse spectrum
Vertical resolution: [a]	4 cm (4–24 kHz) 6 cm (4–20 kHz) 8 cm (4–16 kHz)	6 cm (2–15 kHz) 8 cm (2–12 kHz) 10 cm (2–10 kHz)	19 cm (1–5.0 kHz) 12 cm (1.5–7.5 kHz) 8 cm (2–12 kHz)
Penetration in coarse and calcareous sand: [b]	2 m (typ)	6 m (typ)	30 m (typ)

Table 2-4: Tow Vehicle Specifications (Continued)

	SB-424	SB-216S	SB-512i
Penetration in soft clay: [b]	40 m	80 m	250 m
Beam width: [c]	16°, 4–24 kHz 19°, 4–20 kHz 23°, 4–16 kHz	17°, 2–15 kHz 20°, 2–12 kHz 24°, 2–10 kHz	41°, 0.5–5 kHz 32°, 1–6 kHz 24°, 1.5–7.5 kHz 16°, 2–12 kHz
Optimum tow vehicle pitch/roll:	<7°, 4–24 kHz <8°, 4–20 kHz <10°, 4–16 kHz	<7°, 2–15 kHz <8°, 2–12 kHz <10°, 2–10 kHz	<16°, 0.5–5 kHz <13°, 1–6 kHz <10°, 2–8 kHz <8°, 2–10 kHz <7°, 2–12 kHz
Optimum tow height:	3–5 m above sea floor	3–5 m above sea floor	3–5 m above sea floor
Transmitters:	1	1	2
Receive arrays:	2	2	4
Output power:	2000 W	2000 W	2000 W
Tow vehicle size:	77 cm (30 in.) L 50 cm (20 in.) W 34 cm (13 in.) H	105 cm (41 in.) L 67 cm (26 in.) W 46 cm (18 in.) H	158 cm (62 in.) L 134 cm (53 in.) W 46 cm (18 in.) H
Shipping container size:	91 cm (36 in.) L 66 cm (26 in.) W 64 cm (25 in.) H	117 cm (46 in.) L 79 cm (31 in.) W 61 cm (24 in.) H	173 cm (68 in.) L 137 cm (54 in.) W 71 cm (28 in.) H
Weight in air:	35 kg (78 lb)	72 kg (160 lb)	186 kg (410 lb)
Shipping weight:	110 kg (243 lb)	162 kg (357 lb)	356 kg (783 lb)
Tow cable requirements:	3 shielded twisted wire pairs	3 shielded twisted wire pairs	3 shielded twisted wire pairs
Depth rating:	300 m (984 ft) max	300 m (984 ft) max	300 m (984 ft) max

a. Vertical resolution is the smallest distinguishable distance between the peaks of two reflections that can be displayed on the screen as separate reflectors. Sound energy is reflected back to the sonar system when the transmitted pulse encounters a change in density. The resolution of a sonar system is measured by its ability to distinguish between two adjacent targets. The vertical resolution is dependent on the transmitted chirp pulse bandwidth. It is theoretically calculated by the product of the transmitted pulse length (inverse of the bandwidth) and half the speed of sound in water (approximately 750 m/s). For example, a full bandwidth pulse from an SB-424 Tow Vehicle has a vertical resolution of 3.75 cm (1/20,000 x 750).

b. The value for sub-bottom penetration is the maximum distance beneath the sea floor that a step change of 10% in density can be seen on the sub-bottom display. This assumes that the sediment is gas free (no organic materials), that the lowest frequency of the pulse spectrum is transmitted and that the vehicle is within 5 meters of the seabed (range for maximum penetration). Lower frequencies reduce attenuation (absorption of sound). Towing the vehicle close to the sea floor reduces the acoustic footprint thereby reducing scattering (interfering reflections) from the sea floor and within the sediments.

c. At the -3 dB points, depending on the center frequency.

2.3 75-Meter Kevlar Reinforced Tow Cable

The general specifications for the 75-Meter Kevlar Reinforced Tow Cable are shown in Table 2-5.

Table 2-5: 75-Meter Kevlar Reinforced Tow Cable Specifications

Twisted shielded wire pairs:	(1) #16 AWG (2) #20 AWG
Braking strength:	1600 kg (3500 lb)
Working strength:	295 kg (650 lb)
Weight in air:	30.8 kg/100 m (207 lb/1000 ft)
Voltage rating:	600 volts
Bending radius:	25.4 cm (10.0 in.) minimum
Length:	75 m (245 ft) standard

SECTION 3: Setup and Test

Setup and test of the EdgeTech 3200-XS Sub-Bottom Profiling System encompasses unpacking, inspecting and connecting the system components, including an optional printer; connecting a navigation system and external sonar systems if required; activating the system; and verifying operation using the EdgeTech DISCOVER 3200SB software. This section provides instructions on how to perform these tasks as well as some information on how to deploy and tow the tow vehicle.

3.1 Unpacking and Inspection

The Deck Unit; the SB-424, SB-216S or SB-512i Tow Vehicle; and the 75-Meter Kevlar Reinforced Tow Cable are shipped in separate, reusable heavy duty transport cases. Included also are all the necessary cables and documentation. Before unpacking the system components, inspect the shipping containers for any damage. Report any damage to the carrier and to EdgeTech. If the shipping containers appear free of damage, carefully unpack the components and inspect them for damage. Also check the packing list and verify that all the items on the list are included. Again, if any damage is found, report it to the carrier and to EdgeTech. If any items are missing, immediately contact EdgeTech. Do not install or operate any equipment that appears to be damaged.

Although the items shipped may vary, depending on the customer requirements, the 3200-XS Sub-Bottom Profiling System typically includes the following:

- Deck Unit
- SB-424, SB-216S or SB-512i Tow Vehicle
- 75-Meter Kevlar Reinforced Tow Cable
- AC power cords (2)
- Software CDs
- Manuals

After unpacking the system components, be sure to safely store the shipping containers, including any packing materials, for later use. When transporting or storing the system, all items should be packed in their original shipping containers in the same manner in which they were originally shipped, and always store the system in a dry environment when not in use.

3.2 Power Requirements

The system power requirements are 120–220 VAC, 50/60 Hz. For the 3200-XS Topside Processor, the input voltage is auto sensing. For the Power Amplifier you must select 120 VAC or 220 VAC operation manually.

3.2.1 Use of an Uninterruptable Power Supply

The AC power source should be continuously free of high amplitude, high frequency transients, as this type of interference could cause degraded performance or damage to the equipment. An uninterruptable power supply (UPS) with power surge protection is recommended for powering the equipment. However, whether or not a UPS is used, the AC power source should never be the same as that being used to power electric motors, such as pumps and winches, on the survey vessel.

3.2.2 Selecting the Power Amplifier Input Power Voltage

To select the Power Amplifier input power voltage, first remove the amplifier from the rack. Then remove the top cover, locate the board at the lower right corner and switch to the required input power voltage as indicated by the arrow.

3.2.3 Changing to a Non-US Power Plug

An AC power cord is provided for connecting the Deck Unit to a standard U.S. 3-pronged outlet. For non-U.S. power outlets you can modify this cord by cutting off the 3-pronged plug and attaching the appropriate plug. Refer to Table 3-1 for connection information.

AC POWER CORD WIRE COLOR	FUNCTION
Black	AC line
White	AC neutral
Green	Earth ground

Table 3-1: AC Power Cord Wiring

NOTE: **The Deck Unit is shipped configured for the end user's country voltage requirements.**

3.3 Navigation Interface

The 3200-XS Sub-Bottom Profiling System accepts all standard National Marine Electronics Association (NEMA) 0183 message sentence formats from a connected global positioning system (GPS) or integrated navigation system.

3.4 Locating the Deck Unit

The Deck Unit should be located and set up in a dry, sheltered area that is protected from weather and water spray and where the temperature is consistently between 0°C and 40°C (32°F and 104°F). Avoid areas of direct sunlight, especially in tropical environments, as heat buildup could occur and viewing the LCD monitor and status indicators could be difficult. The location should also enable direct communications with the deck crew that is handling the tow vehicle. Secure the Deck Unit it in place, using tie-downs if necessary, near the required AC power source. If you are mounting the 3200-XS Topside Processor and the Power Amplifier in a 19-inch rack other than the supplied rack mount enclosure, ensure that there is ample room behind the rack for connecting the cables. Support the components inside the rack using appropriate mounting brackets and secure the front panels using standard 19-inch rack front panel mounting hardware.

3.5 Deck Unit Controls and Indicators

The Deck Unit includes controls and indicators on the front and back as shown in Figure 3-1 and Figure 3-2. Several test points are also provided for voltage measurements. The 3200-XS Topside Processor controls, along with a DVD R/W drive and a 3.5-inch are located behind an access panel as shown in Figure 3-3 on page 3-6.

The Deck Unit controls and indicators are the following:

POWER SUPPLY:	Rocker switch. Turns on the power supply in the 3200-XS Topside Processor. This switch can be left in the on position at all times.
SYSTEM POWER:	Push button toggle switch. Turns the 3200-XS Topside Processor on.
POWER:	Rocker switch. Turns the Power Amplifier on. A red indicator above the switch lights when on.
RESET:	Momentary push button switch. Resets the 3200-XS Topside Processor.
HARD DISK:	Red indicator. Indicates when a hard drive on the 3200-XS Topside Processor is active.
SYSTEM:	Green indicator. Illuminated when the 3200-XS Topside Processor is on.
POWER AMP OUT TX1:	Red indicator. Flashes when Channel 1 of the Power Amplifier transmits.

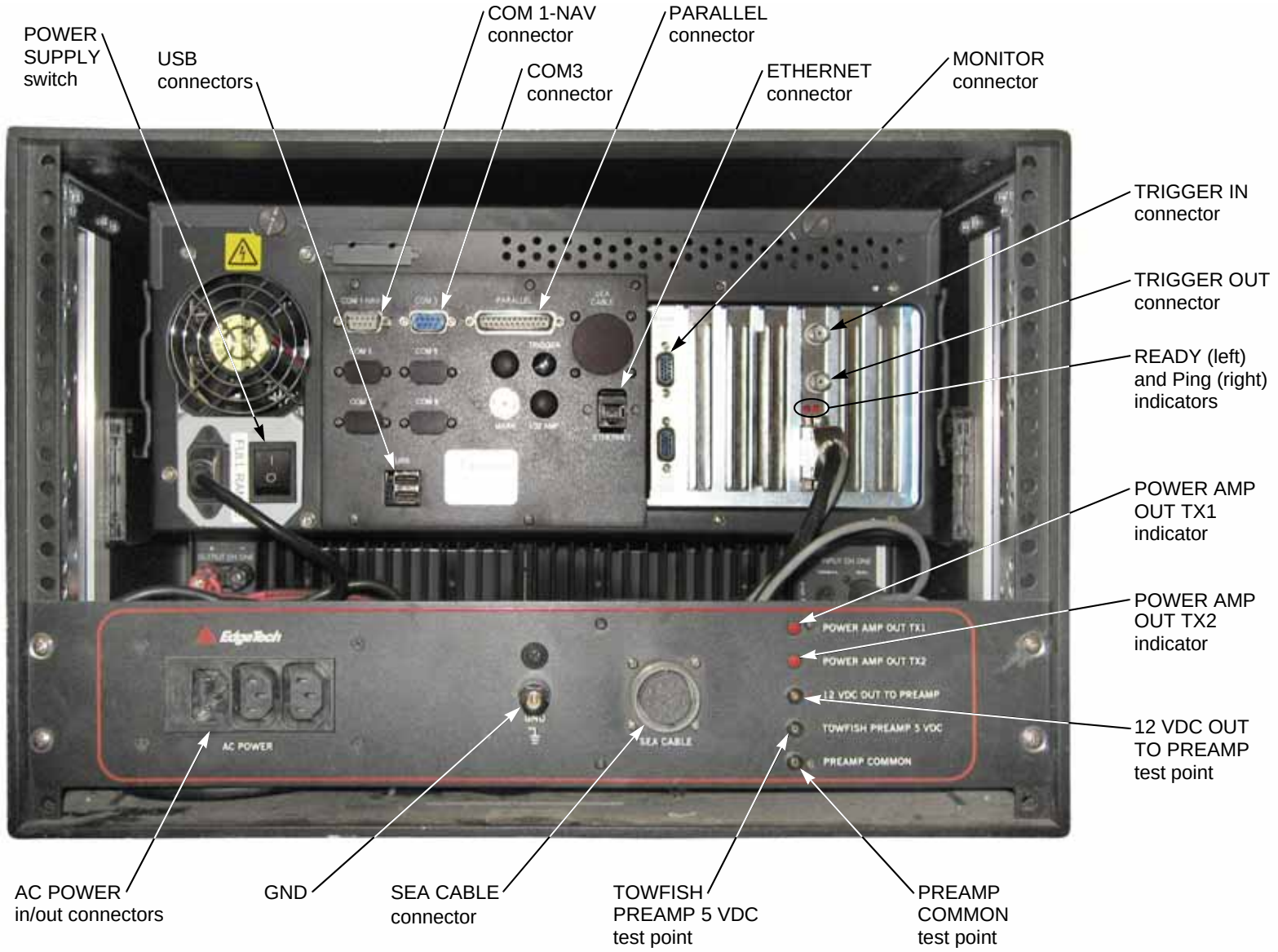


Figure 3-1: Deck Unit Back Side

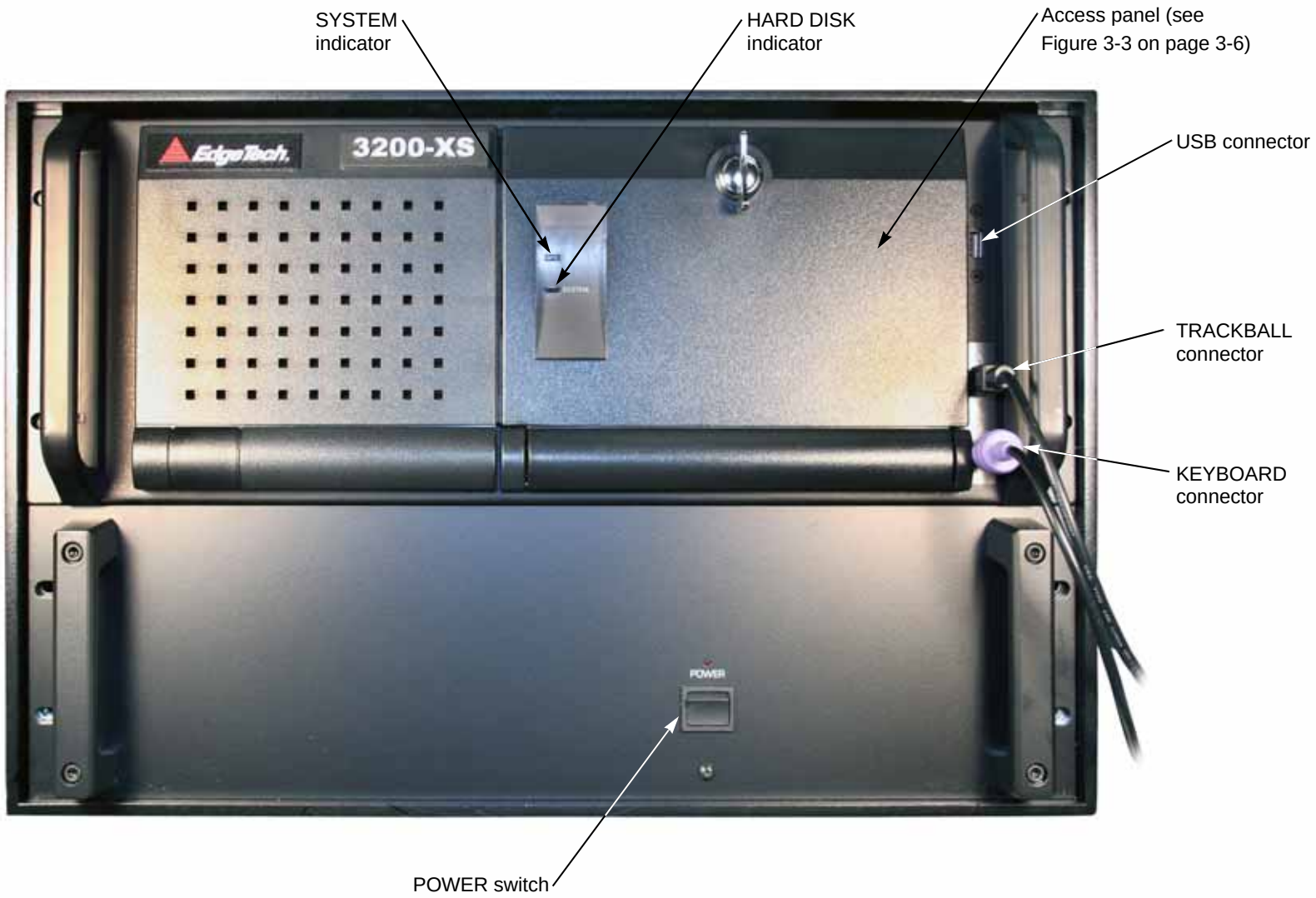


Figure 3-2: Deck Unit Front Side

Figure 3-3: Behind 3200-XS Topside Processor Access Panel

POWER AMP OUT TX2:	Red indicator. Flashes when Channel 2 of the Power Amplifier transmits.
READY:	Red indicator. Illuminates when the system is ready to transmit. On power up it will take one to two minutes for the indicator to illuminate.
PING:	Red indicator. Flashes when the system transmits or when an external trigger is output on the TRIGGER OUT connector.
12 VDC OUT TO PREAMP:	Test point. Used to measure the 12 VDC voltage applied to the preamplifier on the tow vehicle.
TOWFISH PREAMP 5 VDC:	Test point. Used to measure the 5 VDC voltage preamplifier feedback voltage from the tow vehicle.
PREAMP COMMON:	Test point. Common ground for the preamplifier.
GND:	System ground connection.

3.6 Deck Unit Connections

Most of the connections to the Deck Unit are made using connectors on the back. These connectors are shown in Figure 3-1 on page 3-4. The trackball and keyboard connections are made using connectors on the front of the Deck Unit. They are shown in Figure 3-2 on page 3-5.

The Deck Unit connections are the following:

TRACKBALL:	PS2 connector. Connects to the trackball.
KEYBOARD:	PS2 connector. Connects to the keyboard.
SEA CABLE:	11-Pin female bulkhead connector. Connects to the tow cable.
MONITOR:	DB-15 female connector. Connects to the LDC monitor.
COM 1-NAV:	DB-9 female connector. RS-232 serial port that connects to the navigation system.
COM3:	DB-9 female connector. RS-232 serial port that can be used to connect to the navigation system.
PARALLEL:	DB-25 female connector. Connects to an optional printer.
TRIGGER IN:	BNC connector. Connects to an external trigger source to trigger the sonar.
TRIGGER OUT:	BNC connector. Connects to an external sonar system to trigger it.
ETHERNET:	RJ-45 connector. Available for connection to a local area network (LAN).
USB:	(3) USB connectors. Two on the rear panel and one on the front panel.
AC POWER:	CEE-type AC input and output connectors. The AC input connector connects to the AC power source, and the AC output connectors are available for powering the LCD monitor and other equipment if required.

3.7 Connecting the System Components

All of the 3200-XS Sub-Bottom Profiling System components, including optional components, such as a printer, a navigation system, and external sonar systems, are made to the Deck Unit.

WARNING!

Do not connect the tow cable to the Deck Unit before connecting it to the tow vehicle, otherwise injury or death can occur if the exposed connector on the tow cable is energized. Always connect the tow cable to the tow vehicle first.

When connecting the system components, refer to “Deck Unit Connections” on page 3-7 for the location and description of the connectors on the Deck Unit.

3.7.1 Connecting and Attaching the 75-Meter Kevlar Reinforced Tow Cable to the Tow Vehicle

A 75-Meter Kevlar Reinforced Tow Cable is shown connected and attached to a SB-216S Tow Vehicle in Figure 3-4, and is similar to that for the SB-424 and SB-512i Tow Vehicles. Shown in Figure 3-5 is the recommended method for dressing and strain relieving the tow cable.

To connect and attach the tow cable to the tow vehicle:

1. Verify that the tow cable is not connected to the Deck Unit.
2. Coil the tow cable in a figure eight configuration.
3. Verify that the tow cable and tow vehicle connectors are free of corrosion or dirt. If dirty, clean them with an alcohol wipe.
4. Apply a thin film of silicone grease to the pins of the tow vehicle tow cable connector (see “Inspecting and Cleaning the Underwater Connectors” on page 4-2).
5. Mate the connectors by pressing them firmly together. Do not wiggle the connectors.
6. Mate the connector locking sleeves.
7. Connect the eyelet of the cable grip to the shackle on the tow bridle and secure them with seizing wire or a tie wrap.
8. Secure the tow cable to the tow bridle using tie wraps. Electrical tape can also be used for this purpose.
9. Secure the cable pigtail to tow bridle ensuring that there is proper strain relief and that the connector does not strum or move in the water current.

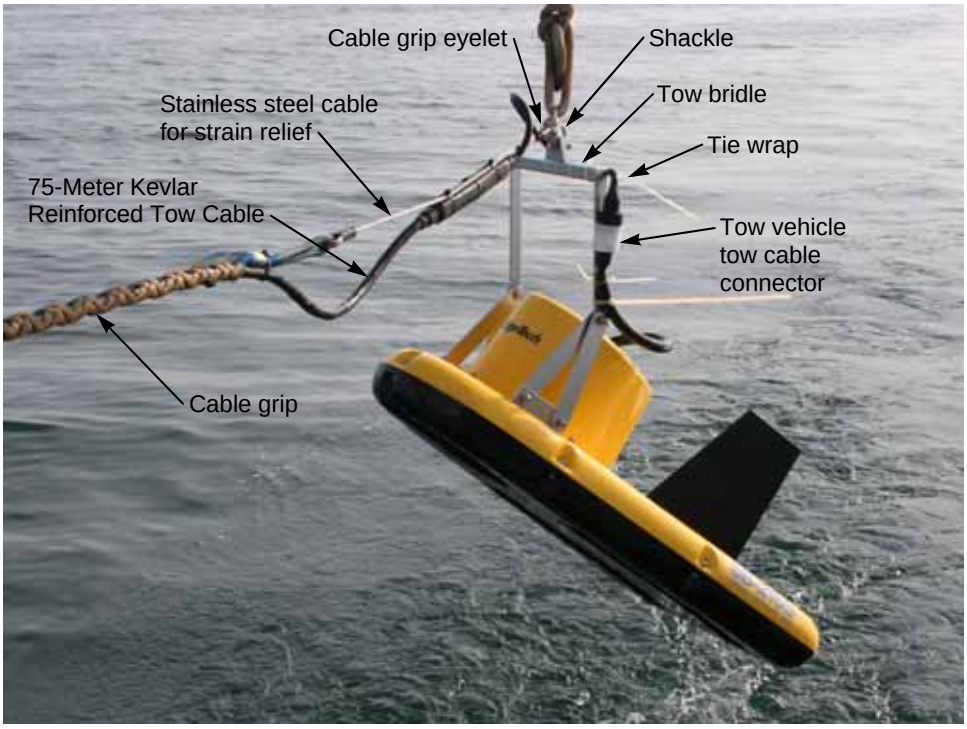


Figure 3-4: A 75-Meter Kevlar Reinforced Tow Cable Shown Connected and Attached to an SB-216S Tow Vehicle

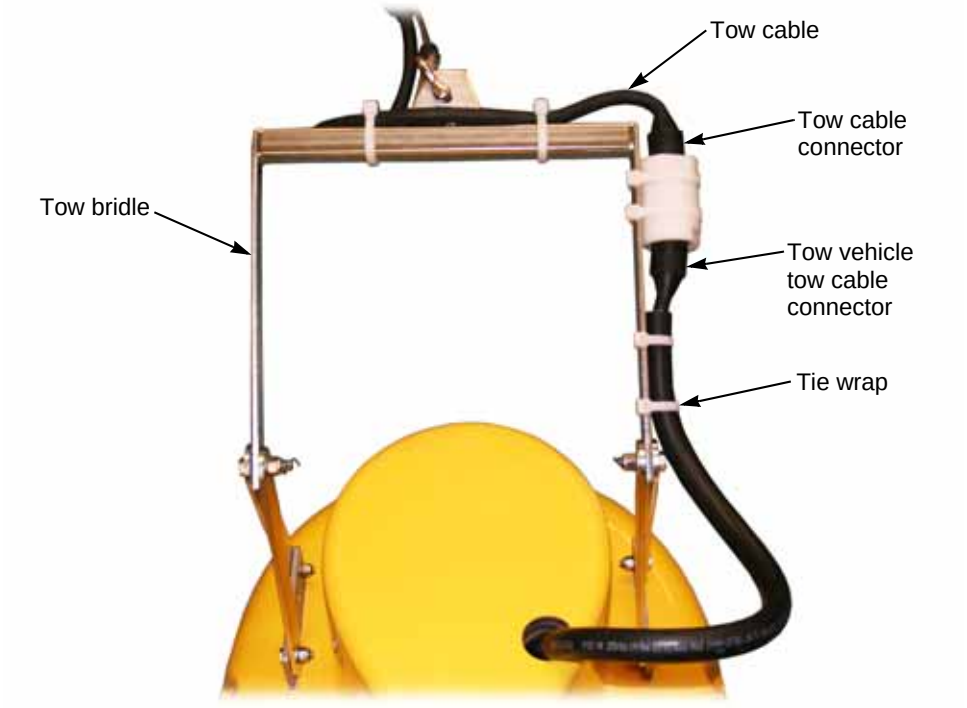


Figure 3-5: Recommended Method for Dressing and Strain Relieving the Tow Cable

3.7.2 Connecting the Deck Unit

To connect the Deck Unit:

1. Verify that the Deck Unit is *not* connected to AC power.
2. Refer to “Selecting the Power Amplifier Input Power Voltage” on page 3-2 and select or verify the correct input power voltage.
3. Verify that the tow cable is properly connected and attached to the tow vehicle, and then connect the tow cable to the SEA CABLE connector.
4. Connect the LCD monitor to the MONITOR connector.
5. Connect the trackball to the TRACKBALL connector.
6. Connect the keyboard to the KEYBOARD connector.
7. If a printer is to be used, connect the printer to the PARALLEL connector. For information on the printers that can be connected to the 3200-XS Sub-Bottom Profiling System, refer to “APPENDIX A: Printer Connections.”
8. If a navigation system is to be used, connect the navigation system output to the COM 1-NAV connector.
9. If an external source is to be used to trigger the 3200-XS Sub-Bottom Profiling System, connect the trigger output of this source to the TRIGGER IN connector.
10. If an external sonar system is to be triggered by the 3200-XS Sub-Bottom Profiling System, connect the trigger input of this system to the TRIGGER OUT connector.
11. Connect an AC power cord to an AC POWER out connector and to the LCD monitor.
12. Connect an AC power cord to the AC POWER input connector and to the AC power source.

3.8 System Activation and Test

After the connections to the Deck Unit have been completed, the 3200-XS Sub-Bottom Profiling System can be activated and some predeployment checks performed prior to deployment of the tow vehicle as a test to verify that the system is operating properly.

When performing the system activation and test, refer to “Deck Unit Controls and Indicators” on page 3-3 for the location and description of the controls and indicators on the Deck Unit. In addition, should the system not activate properly or the predeployment checks fail, refer to “Troubleshooting” on page 4-7 for some assistance on how to correct the problem.

3.8.1 Activating the System

To activate and test the system:

1. Turn on the POWER SUPPLY switch on the back of the Deck Unit. This switch can be left in the on position at all times if desired.
2. Turn on the POWER switch on the Power Amplifier.
3. Turn on the SYSTEM POWER switch on the 3200-XS Topside Processor.

   The SYSTEM indicator on the 3200-XS Topside Processor should illuminate and remain on, and the HARD DISK indicator should flash for two to three minutes while a self test is run. After this test is completed, the HARD DISK indicator will flash periodically.
4. Turn on the LCD monitor.

3.8.2 Performing the Predeployment Checks

The predeployment checks should be performed after the system is activated and before the tow vehicle is deployed. These checks involve listening for the transmitted pulses from the transducers on the tow vehicle and rubbing your hand near the hydrophone arrays while observing the Sonar display in the DISCOVER 3200SB Main window.

> ***NOTE:*** **For detailed information about the EdgeTech DISCOVER 3200SB software, refer to the "DISCOVER 3200SB Sub-Bottom Software User's Manual."**

To perform the predeployment checks:

1. Activate the system as described in "Activating the System" above.

   The DISCOVER 3200SB and SONAR.EXE programs will start automatically and the DISCOVER 3200SB Main window will open as shown in Figure 3-6. SONAR.EXE will run a self test and an audible chirp will be heard indicating that the test passed. If the test fails, the SONAR.EXE window will remain on the desktop, and the failure mode will be described in the window.
2. Choose Control Panel from the Sonar menu.

   The Options dialog box shown in Figure 3-7 opens.
3. In the Options dialog box, click the Sonar Control tab.
4. On the Sonar Control tab, make the required settings.
5. Click the Display tab.
6. On the Display tab, set the Gain to either 0 or -3 dB, and then click Norm.

Figure 3-6: The DISCOVER 3200SB Main Window

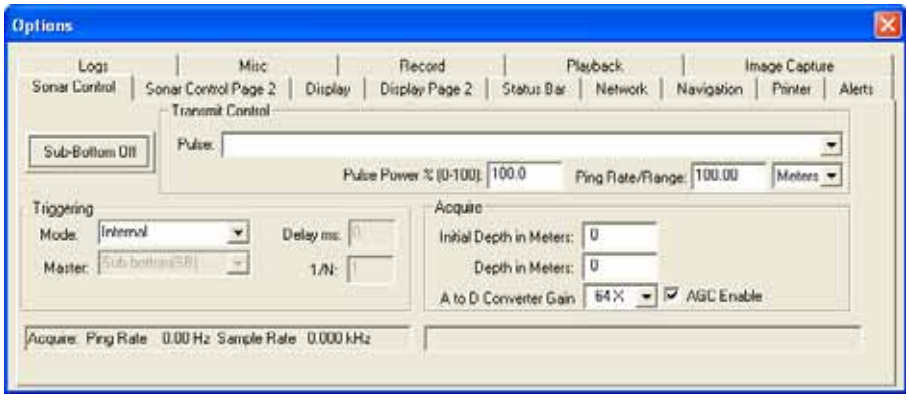


Figure 3-7: The Options Dialog Box, Sonar Control Tab

7. Close the Options dialog box.

CAUTION!

Do not allow the transducers on the tow vehicle to continuously transmit in air for an extended period as damage to the transducers could occur.

8. From the Sonar menu, choose Sonar On. When the sonar is on, a check mark appears next to the menu item.

   The transducers on the tow vehicle should begin transmitting and data should begin scrolling on the display in the DISCOVER 3200SB Main window.

9. Listen for transmissions from the transducers and verify that they are present.

10. Tap the underside of the tow vehicle near the hydrophones with the handle of a screw driver while observing the Sonar display in the DISCOVER 3200SB Main window.

    You should observe streaks or noise spikes in the waterfall display.

3.9 Tow Vehicle Deployment

The SB-424, SB-216S and SB-512i Tow Vehicles can be towed using the 75-Meter Kevlar Reinforced Tow Cable that is available separately with the 3200-XS Sub-Bottom Profiling System. However, it is recommended that a steel cable with a minimum 500 Kg (1100 lb) working strength be used instead of this tow cable to tow the larger SB-0512i vehicle. The steel cable can be secured to the tow cable using electrical tape, making sure there is enough built in slack in the tow cable so that all the load is supported by the steel cable. A steel cable could also be used in the same manner with the two smaller SB-424 and SB-216S Tow Vehicles to increase the life of the tow cable. For towing in deep water, a single armored tow cable is required.

CAUTION!

Do not tow the tow vehicle too close to the survey vessel. Towing in this manner can cause the tow vehicle to be pulled in against the hull of the ship due to the low pressure of the propeller wash and the effect of the water flowing by the hull. In addition, sonar reflections from the hull may be evident in the records.

The tow vehicle may be towed at speeds of up to 10 knots. However, to optimize performance and minimize flow noise, it is recommended that the tow vehicle be towed at speeds of less than 5 knots. Lead ballast in the nose of the tow vehicle provides towing stability by allowing the tow point to be placed as far forward as possible and by making the

tow point well above the center of gravity of the tow vehicle. The tow point is factory adjusted so that the tow vehicle is level when it is towed in the water at 3 to 5 knots.

CAUTION!

Do not tow the tow vehicle with the nose angled up or down. Doing so can degrade the sonar imagery. Before towing the tow vehicle, verify that it is as level as possible when towing the tow vehicle at 3 to 5 knots.

3.9.1 Obtaining the Best Sonar Imagery When Towing

To generate good sonar imagery, the pitch of the vehicle, which is how much in degrees the nose is angled up or down, must be less than one half of the -6 dB beam width of the acoustic pulse at its highest frequency—and less at lower frequencies. As a rule of thumb, for a 0.5-meter long hydrophone array, the -6 dB beam width at 10 kHz is 20 degrees. For example, if you are transmitting a 2 to 15 kHz FM pulse using a tow vehicle with a 0.5-meter long receiving array, such as in the SB-216S or SB-216D Tow Vehicle, you must keep the tow vehicle from pitching more than about 7 degrees in either direction, or

1/2 x 20 degrees x 10 kHz/15kHz = 6.6 degrees.

The same criteria applies to vehicle roll, which is how much in degrees it is listing to port or starboard. Sensors can be installed on the tow vehicle to measure its pitch and roll under various towing conditions.

3.9.2 Conducting Sediment Classification Surveys When Towing

To conduct sediment classification surveys, the reflection coefficient should be measured with better than 10% accuracy. The normal component of the sea floor reflection must arrive within the angle corresponding to one half of the -1 dB beam width of the acoustic axis of the vehicle at the center frequency of the pulse, the frequency where most of the acoustic energy is concentrated and where the reflection coefficient is measured. As a rule of thumb, for a 0.5-meter long hydrophone array, the -1 dB beam width at 10 kHz is 4 degrees.

For example, if the sea floor is expected to have slopes of up to 5 degrees during the survey, and a vehicle with a 0.5-meter hydrophone array and a 2 to 10 kHz FM pulse is selected, the -1 dB beam width should be at least 10 degrees at 6 kHz. For this pulse and receiving array, the -1 dB beam width at 6 kHz is about 7 degrees, or

4 degrees x 10 kHz/6 kHz = 6.6 degrees.

Therefore only reflection coefficient measurements made when the sea floor slope is within 3.5 degrees of horizontal will be accurate within 10% (1 dB).

The attitude of the tow vehicle with respect to the horizontal plane must meet the -1 dB criteria described above for sediment classification surveys. Rough sea conditions will tend to move the vehicle up and down vertically causing oscillations in the images. DISCOVER 3200SB has a swell filter that will help reduce the heave effect on the record. Refer to the “DISCOVER 3200SB Sub-Bottom Software User’s Manual” for details. For sediment classification, the tow fish pulses must be calibrated by the end user. This calibration procedure is described in the software manual.

SECTION 4: Maintenance and Troubleshooting

The 3200-XS Sub-Bottom Profiling System is ruggedly designed and built and therefore requires little maintenance. However, to ensure long lasting and reliable service, some periodic maintenance is recommended. This section provides some maintenance recommendations and includes instructions on how to disassemble and reassemble a tow vehicle should it be required to replace internal components. In addition, some troubleshooting procedures are included, along with connector pinout and wiring information, to assist in identifying and correcting possible setup or operational problems should they occur.

4.1 Periodic Maintenance

Maintenance on the 3200-XS Sub-Bottom Profiling System should be performed on a regular basis, as often as necessary, depending on use. However, most of the maintenance is performed after each deployment and recovery cycle of the tow vehicle. Other maintenance, such as cleaning of the air filter in the 3200-XS Topside Processor, can be performed as necessary.

4.1.1 Cleaning the Air Filter in the 3200-XS Topside Processor

The 3200-XS Topside Processor in the Deck Unit includes an air filter located behind the front panel vent. Keeping the air filter clean will prevent heat buildup that can cause damage to heat sensitive electronics. The filter should be cleaned regularly, as often as necessary, to ensure that it remains clean. To access the filter, open the front panel vent, and then slide the filter out by pulling it to the right. Clean the filter using a vacuum cleaner or compressed air.

4.1.2 Cleaning the Tow Vehicle and Tow Cable after Use

After retrieving the tow vehicle from the water, use a hose to wash it down, along with the tow cable, with clean, fresh water. Thoroughly spray the transducers and the hydrophone arrays from underneath the tow vehicle and remove any buildup of debris that may have been trapped inside. Inspect the inside of the tow vehicle, especially the transducers, the hydrophone arrays and the cables for any damage and for any loose connectors. Also inspect the tow cable and the connectors on each end.

After washing down the tow vehicle, clean the transducers and hydrophone arrays using a mild, non-abrasive detergent and water. Do not use any abrasive detergents or ammonia based cleaners. After cleaning, thoroughly spray the transducers and hydrophones again with fresh water.

4.1.3 Inspecting and Cleaning the Underwater Connectors

Regularly inspect the contacts on the male pins of each underwater connector in the tow vehicle and on the tow cable for corrosion or oxidation. To remove any oxidation, rub the contacts lightly with 800 grit emery cloth cut into strips equal to or less than the width of a contact. A pencil eraser can also be used for this purpose. The female sockets can be cleaned using a cotton swab and rubbing alcohol. A .22 caliber bore brush with only nylon bristles can be used to remove light oxidation.

To extend the life and increase the reliability of the connectors, apply a thin film of silicone dielectric grease, such as Novagard G624 general purpose silicone grease or an equivalent, to the entire surface of each male pin. A small amount of grease should also be applied to the opening of each female socket.

> ***NOTE:*** **Remember to always install dummy connectors on the connectors of the tow cable and the tow vehicle tow cable connector.**

4.1.4 Storage

When not in use, all the components of the 3200-XS Sub-Bottom Profiling System should be packed in their original shipping containers in the same manner in which they were originally shipped and stored in a dry area.

4.2 Restoring the Operating System to the Hard Drive

The 3200-XS Topside Processor contains an 80-GB hard drive for both the operating system and the application software. A separate 160-GB hard drive is also included for data recording. An image file of the 80-GB hard drive is provided on a CD. This CD can be used to completely restore the 80-GB hard drive to its original shipped factory configuration in the unlikely event of its failure. For instructions on how to restore the operating system hard drive, refer to the “DISCOVER 3200SB Sub-Bottom Software User’s Manual.”

4.3 Disassembling and Reassembling a Tow Vehicle

The procedures below describe how to disassemble and reassemble a tow vehicle to access the transducers, hydrophones, transformers, inductors, spider boxes, spider arrays, and preamplifiers. The tools required are a socket wrench, 7/16 and 1/2-inch sockets, and a small flat screw driver. For information on where the components are located, refer to Figure 4-3, and for their part numbers, refer to the drawings in “Wiring and Connector Pinout Drawings” on page 4-12.

4.3.1 Disassembling a Tow Vehicle

To disassemble a tow vehicle:

1. Using the blade of the screw driver, pry out the retaining ring from the locking sleeve as shown in Figure 4-1.

Figure 4-1: Retaining Ring and Locking Sleeve

2. Remove the retaining ring and the locking sleeve from the connector as shown in Figure 4-2.

Figure 4-2: Retaining Ring and Locking Sleeve Removed

Figure 4-3: SB-424, SB-216S and SB-512i Tow Vehicle Transducers, Hydrophones, Transformers, Inductors, Spider Boxes, Spider Arrays, And Preamplifiers

3. Using the socket wrench with the 7/16-inch socket, remove all the bolts securing the teardrop cover to the body of the tow vehicle as shown in Figure 4-4.

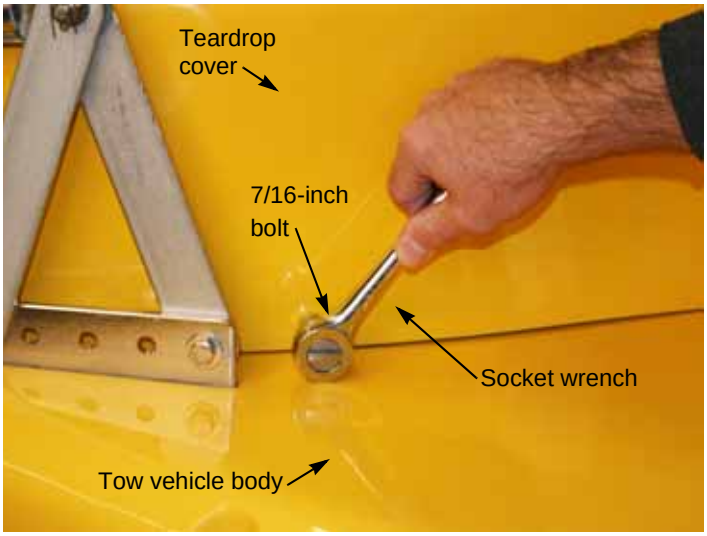


Figure 4-4: Removing the 7/16-Inch Bolts Securing the Teardrop Cover to the Tow Vehicle

4. Remove the teardrop cover as shown in Figure 4-5.

Figure 4-5: Removing the Teardrop Cover

5. Disconnect the spider cable from the components shown in Figure 4-6.

Figure 4-6: Teardrop Cover Removed

6. Using the socket wrench with the 7/16-inch socket, remove all of the bolts and nuts securing the front half of the top cover of the tow vehicle body as shown in Figure 4-7. Continue with the rear half using a 1/2-inch socket.
7. Lift the top cover off, turn it over and disconnect the spider cable from the hydrophones and the preamp components.

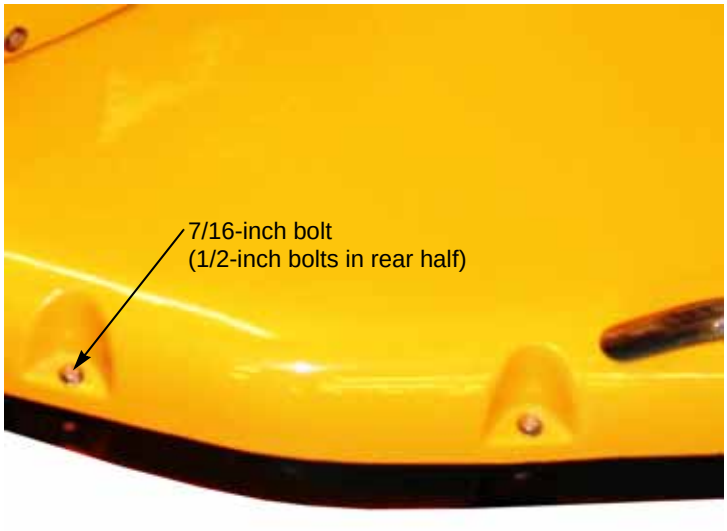


Figure 4-7: Removing 7/16 and 1/2-Inch Bolts and Nuts Securing the Top Cover of the Tow Vehicle Body

4.3.2 Reassembling the Tow Vehicle

To reassemble the tow vehicle reverse the disassembly procedure described in “Disassembling a Tow Vehicle” on page 4-3.

4.4 Troubleshooting

Should some operational or performance problems occur with the 3200-XS Sub-Bottom Profiling System, it may be possible to correct them using the troubleshooting guide provided in Table 4-1. This troubleshooting guide identifies some symptoms that could occur and presents one or more possible causes and the recommended corrective action for each. When using the troubleshooting guide, perform the corrective action for any given symptom in the order of possible causes, which generally corresponds to the degree of troubleshooting difficulty, from the simple to the more complex.

Before proceeding with any corrective action, verify the following:

- The Deck Unit is plugged into an appropriate AC power source (see “Power Requirements” on page 3-2).
- The AC cables inside the Deck Unit are plugged into the 3200-XS Topside Processor and the Power Amplifier and to the AC power outlet.
- The 3200-XS Topside Processor and the Power Amplifier are switched on.

NOTE: **Be sure to also verify that all the cables in the Deck Unit and the tow vehicle are properly mated and are not loose or damaged. Most causes of operational or performance problems are a result of poor connections.**

Table 4-1: System Troubleshooting Guide

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
Red POWER switch indicator on the Power Amplifier does not turn on when the switch is turned on.	Light bulb is burnt out.	Replace the bulb. The Power Amplifier will operate with the bulb burnt out.
	Power outlet fuse is blown.	Check the fuse in the AC power outlet at the back of the Deck Unit. If blown, replace the fuse. Use a 10 A, 250 V, slow blow, 5 x 20 mm fuse.
	Power Amplifier fuse is blown.	Check the fuse at the back of the Power Amplifier. If blown, replace the fuse. Use a 15 A, 250 V fast blow fuse.

Table 4-1: System Troubleshooting Guide (Continued)

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
The green SYSTEM indicator on the 3200-XS Topside Processor does not illuminate when the processor is turned on.	AC power is not connected.	Check the AC power cables and verify that the Deck Unit is connected to AC power.
	The indicator is not operating.	Open the 3200-XS Topside Processor and check the indicator and wiring.
The red HARD DISK indicator on the 3200-XS Topside Processor does not flash when the processor is turned on.	The operating system is not booting.	Open the 3200-XS Topside Processor and verify that the 80-GB hard drive is connected to power and that the ribbon cable is properly plugged in. Also verify that the ribbon cable in properly plugged into to the Mother board.
	The indicator is not operating.	Open the 3200-XS Topside Processor and check the indicator and wiring.
When performing the predeployment tests, transmissions from the transducers are not heard.	The Power Amplifier is switched off.	Turn on the Power Amplifier.
	The tow cable is disconnected.	Check the tow cable and verify that it is properly connected on both ends.
	The tow cable is damaged.	Check the tow cable connectors for excessive corrosion or a broken pin. If corrosion or a broken pin is not found, check the continuity of the conductors in the tow cable.
	The Power Amplifier input or output, or both are disconnected.	Verify that the red banana plug (amplifier output) on the back of the Power Amplifier is fully inserted into the red/red sockets (not the red/black sockets).
	The switches on the back of the Power Amplifier are not properly set.	Verify that the switches on the back of the amplifier are set to BRIDGE and .
	The tow vehicle cable harness connections are loose.	Verify that all the cable harness connectors in the tow vehicle are properly mated.

Table 4-1: System Troubleshooting Guide (Continued)

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
When performing the predeployment tests, transmissions from the transducers are not heard. (Cont.)	The Power Amplifier has failed.	Replace the Power Amplifier.
	The test pulse file is corrupted or missing.	Contact EdgeTech for instructions on how to recover the test pulse file.
	The Tiger board has failed.	Replace the Tiger board.
When performing the predeployment tests, signals in the Sonar display are not present.	The tow vehicle cable harness connections are loose.	Verify that all the cable harness connectors in the tow vehicle are properly mated.
	12 VDC power for the preamplifier is not present.	Measure the voltage between the 12 VDC OUT TO PREAMP test point and the PREAMP COMMON test point on the back of the Deck Unit. This voltage should be 12 VDC. If 12 VDC is not present, verify that it is present on the Tiger board in the 3200-XS Topside Processor. If 12 VDC is not present on the Tiger board, repair or replace the Tiger board.
	5 VDC from the preamplifier in the tow vehicle is not present.	Measure the voltage between the TOWFISH PREAMP 5 VDC test point and the PREAMP COMMON test point on the back of the Deck Unit. This voltage should be 5 VDC. If 5 VDC is not present, check the tow cable and the spider mold in the tow vehicle and repair or replace them as necessary. If 5 VDC is still not present, replace the preamplifier in the tow vehicle.

Table 4-1: System Troubleshooting Guide (Continued)

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
Vertical black streaks are present in the Sonar display.	One or more of the underwater connectors are loose or have corroded contacts.	Refer to “Inspecting and Cleaning the Underwater Connectors” on page 4-2 and inspect and clean the connectors. Reconnect the connectors, and if necessary, secure them using duct tape.
	Extended use has caused a conductor in the tow cable or the cable harness in the tow vehicle to break.	Check the continuity of the conductors in the tow cable and in the cable harness.
There is white data dropout in the Sonar display.	The Power Amplifier is overheating.	Check the Power Amplifier for excessive heating.
	A connector is loose or flooded.	Wiggle the tow cable connections and the connectors of the cable harness in the tow vehicle while watching the Sonar display for white streaks. If white streaks are present, refer to “Inspecting and Cleaning the Underwater Connectors” on page 4-2 and inspect and clean the connectors. Reconnect the connectors, and if necessary, secure them using electrical tape or locking sleeves.
There are periodic streaks in the Sonar display from AC noise.	The system is not properly grounded.	Check the continuity between the GND connection on the back of the Deck Unit to ship’s ground.
	The return signals from the hydrophone arrays are being clipped.	Reduce the preamplifier gain or the transmit power, or both.
Noise is present in the Sonar display.	Engine noise is coupling into the sonar frequency band.	Isolate the engine noise.
	The tow vehicle is in or near the ship’s wake.	Tow the tow vehicle at a deeper depth and farther away from the ship.
	The tow vehicle is not level when being towed.	Level the tow vehicle by adjusting the tow point such that the tow vehicle is level when moving through the water at 3 to 5 knots.
	The tow vehicle is being towed too fast.	Lower the speed of the tow vehicle.

4.5 Connector Pinouts

Pinout information is provided for the SEA CABLE connector on the back of the Deck Unit in Figure 4-8 and Table 4-2, and the tow vehicle tow cable connector in Figure 4-8 and Table 4-3.

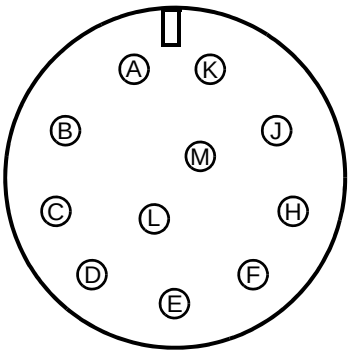


Figure 4-8: SEA CABLE Connector—Female, Face View

Table 4-2: SEA CABLE Connector Pinouts

PIN	FUNCTION
A	Transmitter output shield
B	+12 VDC
C	Sea ground
D	NC
E	Transmitter out 1
F	NC
H	Transmitter out 2
J	Preamplifier output
K	Preamplifier common
L	NC
M	NC

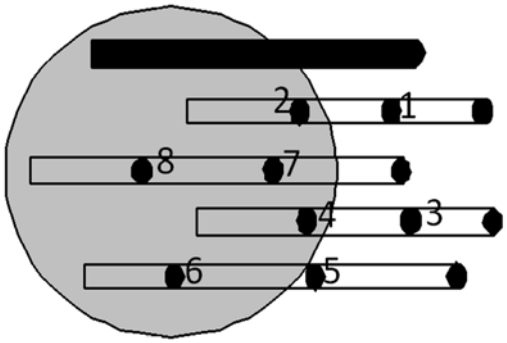


Figure 4-9: Tow Vehicle Tow Cable Connector—Male, Face View

Table 4-3: Tow Vehicle Tow Cable Connector Pinouts

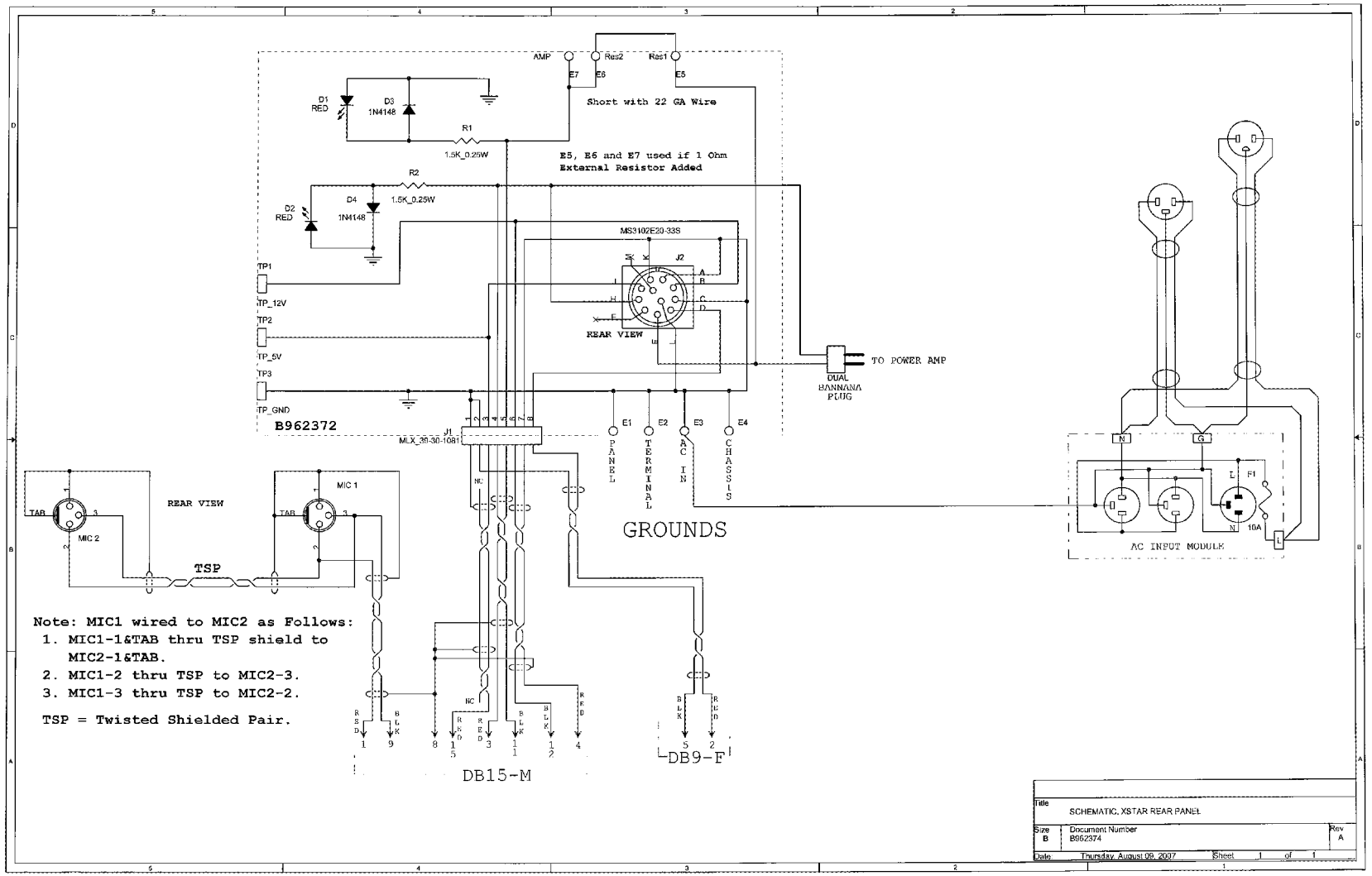
PIN	FUNCTION
1	Transmitter out 1
2	Transmitter out 2
3	Preamplifier common
4	Preamplifier output
5	NC
6	+12 VDC
7	Sea ground
8	NC

4.6 Wiring and Connector Pinout Drawings

Listed in Table 4-4 and included in the following pages are the 3200-XS Sub-Bottom Profiling System wiring and connector pinout drawings for the Deck Unit and the SB-424, SB-216S and SB-512i Tow Vehicles. For the Deck Unit a wiring harness diagram and connector pinout information are provided. For each of the tow vehicles, spider mold and tow vehicle wiring diagrams are provided. The spider mold wiring diagrams also include connector pinout information. In addition, a wiring diagram with connector pinout information for the 75-Meter Kevlar Reinforced Tow Cable is included.

Table 4-4: List of Wiring and Connector Pinout Drawings

DRAWING NUMBER	TITLE
B962374	Wiring Harness, Deck Unit
503-0000008-1000	Wiring Diagram, Spider Box, SB-424 Tow Vehicle
A980966	Wiring Diagram, SB-424 Tow Vehicle
503-0000006-1000	Wiring Diagram, Spider Box, SB-216S Tow Vehicle
A980965	Wiring Diagram, SB-216S Tow Vehicle
503-0000013-1000	Wiring Diagram, Spider Box, SB-512i Tow Vehicle
A980964	Wiring Diagram, SB-512i Tow Vehicle
505-0000010-1000	Wiring Diagram, 75-Meter Kevlar Reinforced Tow Cable


AMP
Res2
Res1
E7
E6
E5
Short with 22 GA Wire
D1
RED
D3
1N4148
R1
1.5K_0.25W
E5, E6 and E7 used if 1 Ohm
External Resistor Added
R2
1.5K_0.25W
D4
1N4148
D2
RED
MS3102E20-33S
J2
REAR VIEW
TP1
TP_12V
TP2
TP_5V
TP3
TP_GND
B962372
J1
MLX_39-30-10811
TO POWER AMP
DUAL
BANNANA
PLUG
E1
E2
E3
E4
PANEL
TERMINAL
AC IN
CHASSIS
GROUNDS
MIC 1
MIC 2
TAB
REAR VIEW
TSP
NC
AC INPUT MODULE
N
G
L
F1
10A
Note: MIC1 wired to MIC2 as Follows:
1. MIC1-1&TAB thru TSP shield to MIC2-1&TAB.
2. MIC1-2 thru TSP to MIC2-3.
3. MIC1-3 thru TSP to MIC2-2.
TSP = Twisted Shielded Pair.
DB15-M
DB9-F
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Size
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Document Number
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Rev
A
Date:
Thursday, August 09, 2007
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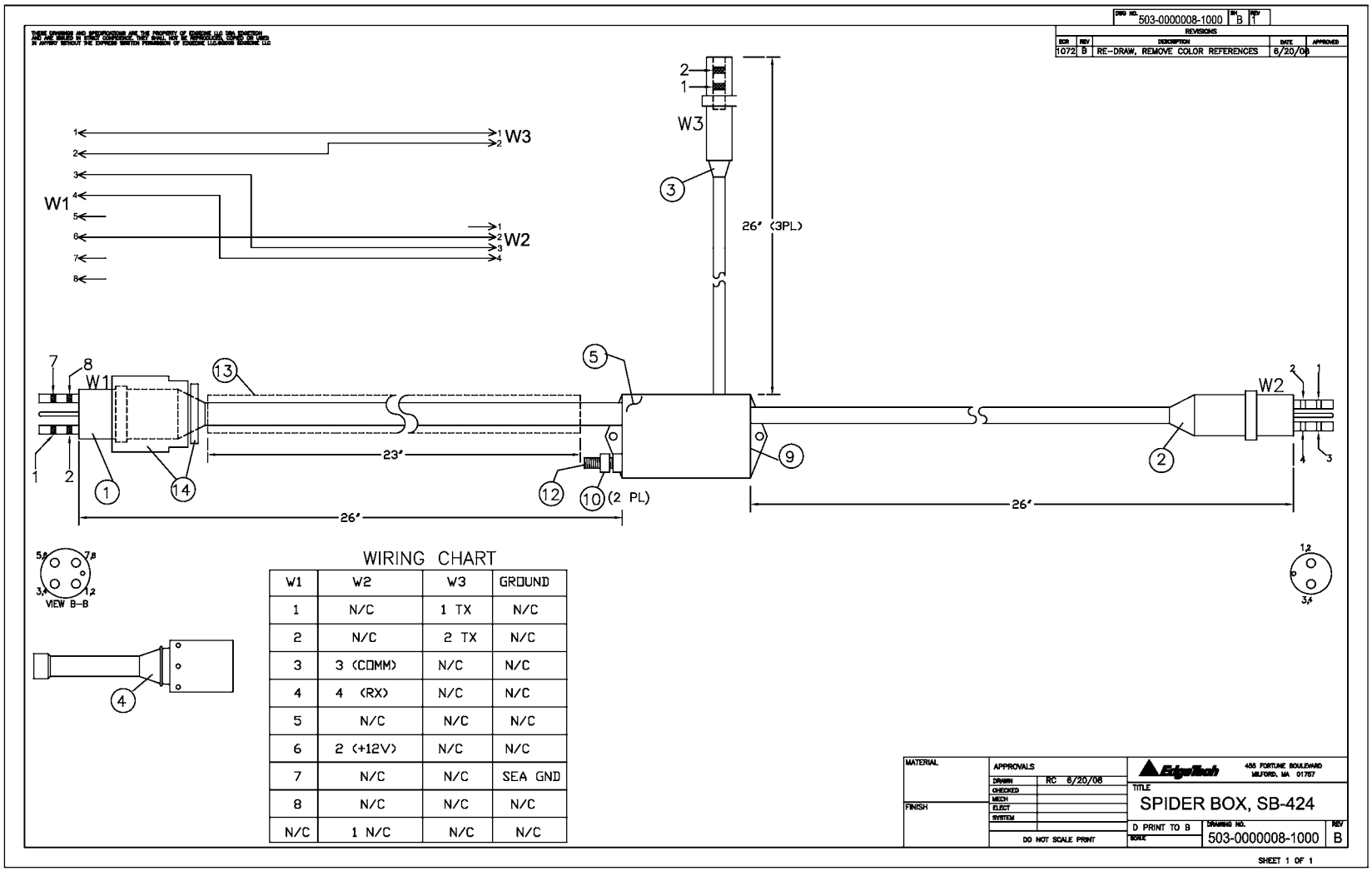
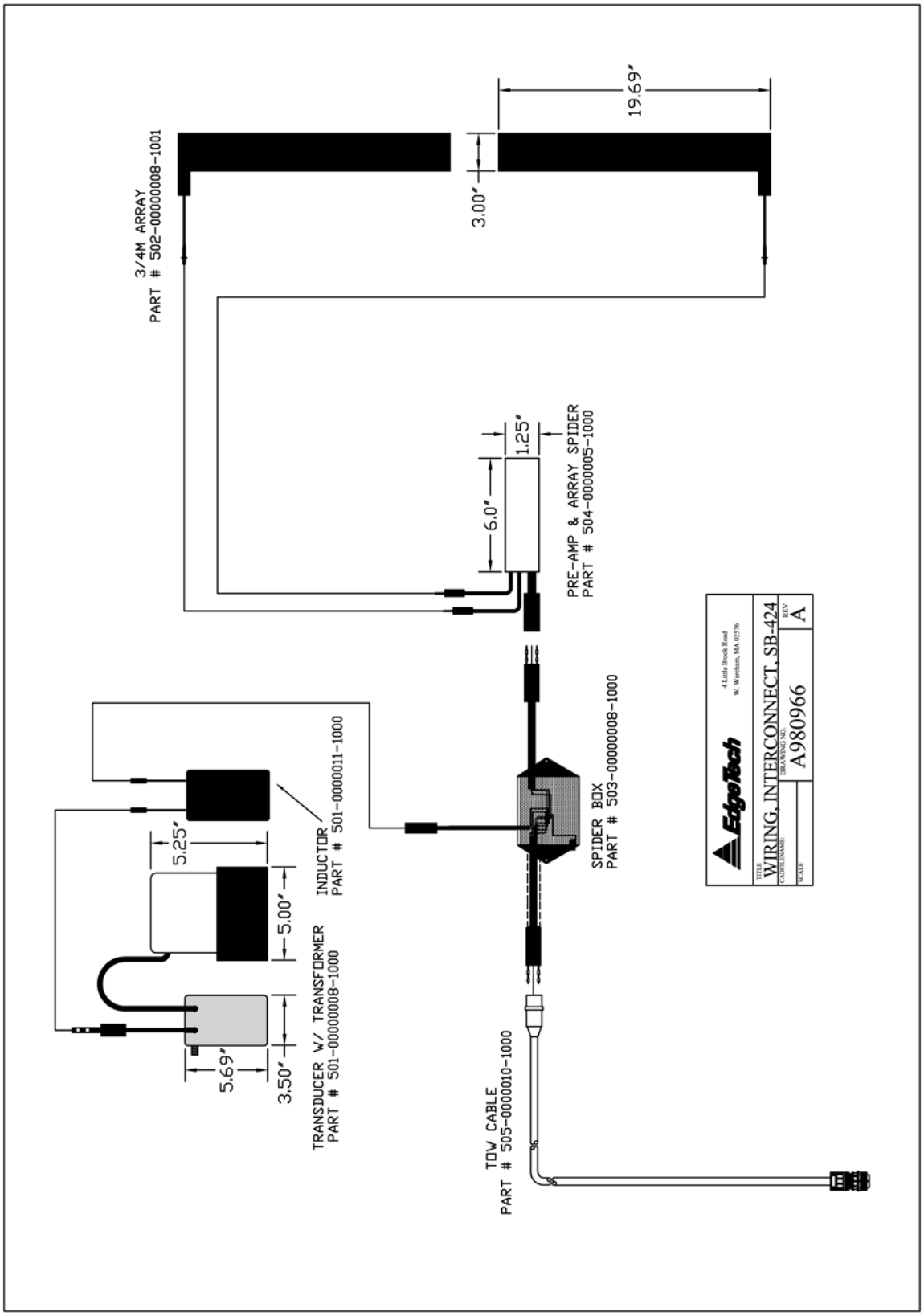
of
1



W1	W2	W3	GROUND
1	N/C	1 TX	N/C
2	N/C	2 TX	N/C
3	3 (COMM)	N/C	N/C
4	4 (RX)	N/C	N/C
5	N/C	N/C	N/C
6	2 (+12V)	N/C	N/C
7	N/C	N/C	SEA GND
8	N/C	N/C	N/C
N/C	1 N/C	N/C	N/C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6.0"
1.25"
PRE-AMP & ARRAY SPIDER
PART # 504-0000005-1000
SPIDER BOX
PART # 503-00000008-1000
TDW CABLE
PART # 505-0000010-1000
INDUCTOR
PART # 501-0000011-1000
TRANSDUCER W/ TRANSFORMER
PART # 501-00000008-1000
5.25"
5.00"
5.69"
3.50"
EdgeTech
4 Little Brook Road
W. Wareham, MA 02576
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DRAWING NO.
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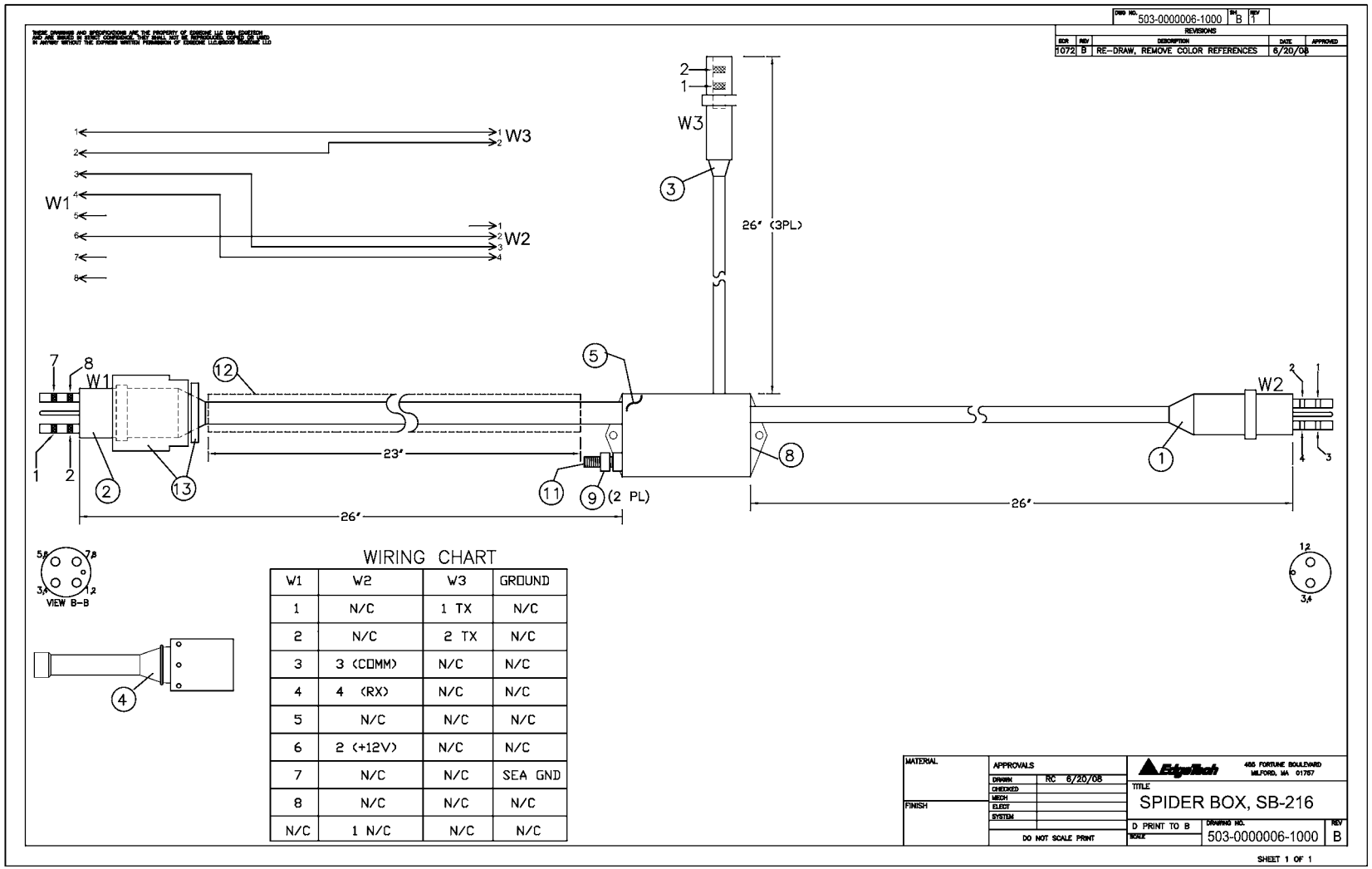
SCALE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W2
W3
26" (3PL)
23"
26"
26"
(2 PL)
VIEW B-B
WIRING CHART
W1 W2 W3 GROUND
1 N/C 1 TX N/C
2 N/C 2 TX N/C
3 3 (COMM) N/C N/C
4 4 (RX) N/C N/C
5 N/C N/C N/C
6 2 (+12V) N/C N/C
7 N/C N/C SEA GND
8 N/C N/C N/C
N/C 1 N/C N/C N/C
MATERIAL
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ELECT
SYSTEM
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EdgeTech
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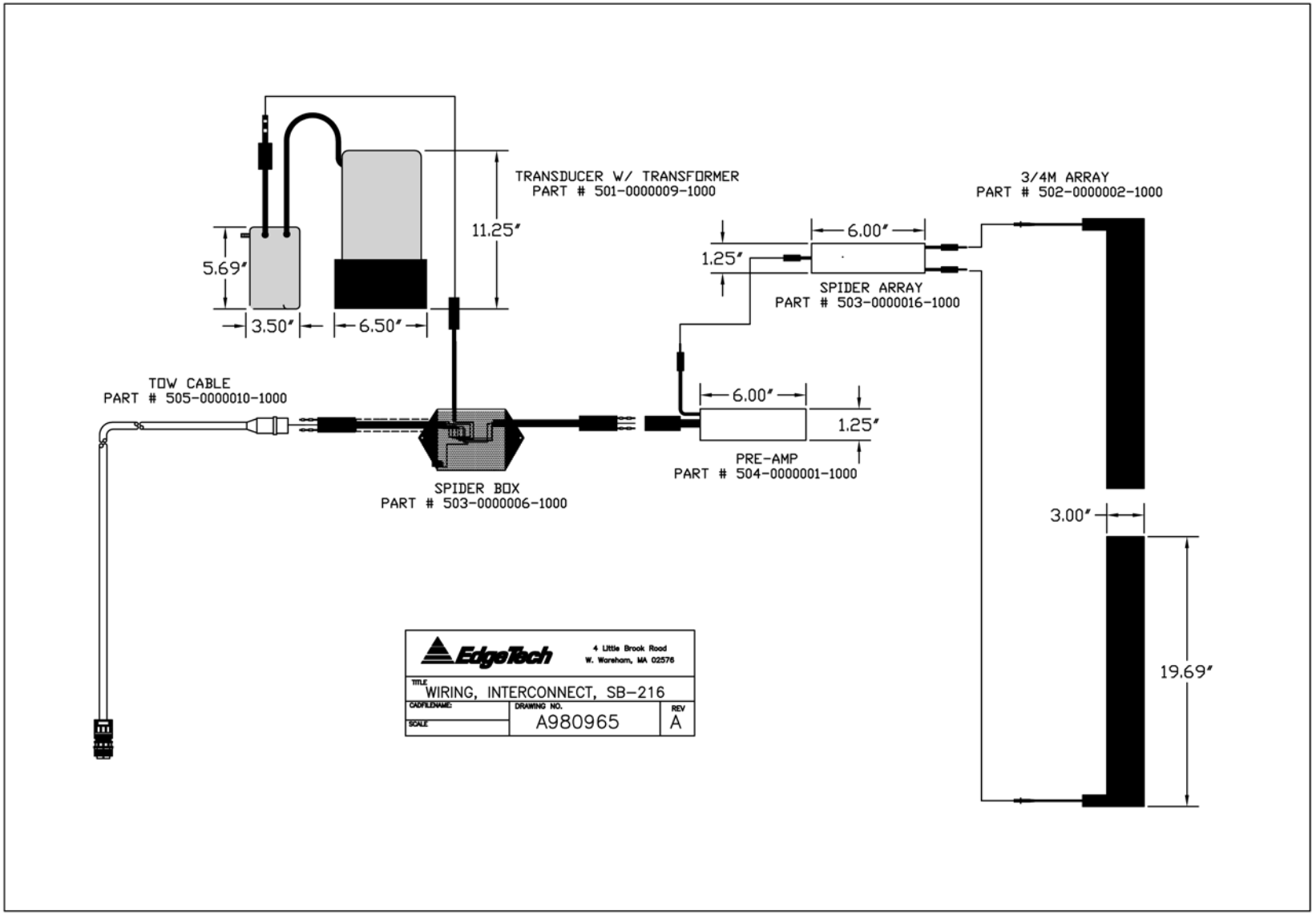
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6.50"
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PART # 502-0000002-1000
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1.25"
SPIDER ARRAY
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TOW CABLE
PART # 505-0000010-1000
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PRE-AMP
PART # 504-0000001-1000
SPIDER BOX
PART # 503-0000006-1000
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EdgeTech
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W. Wareham, MA 02576
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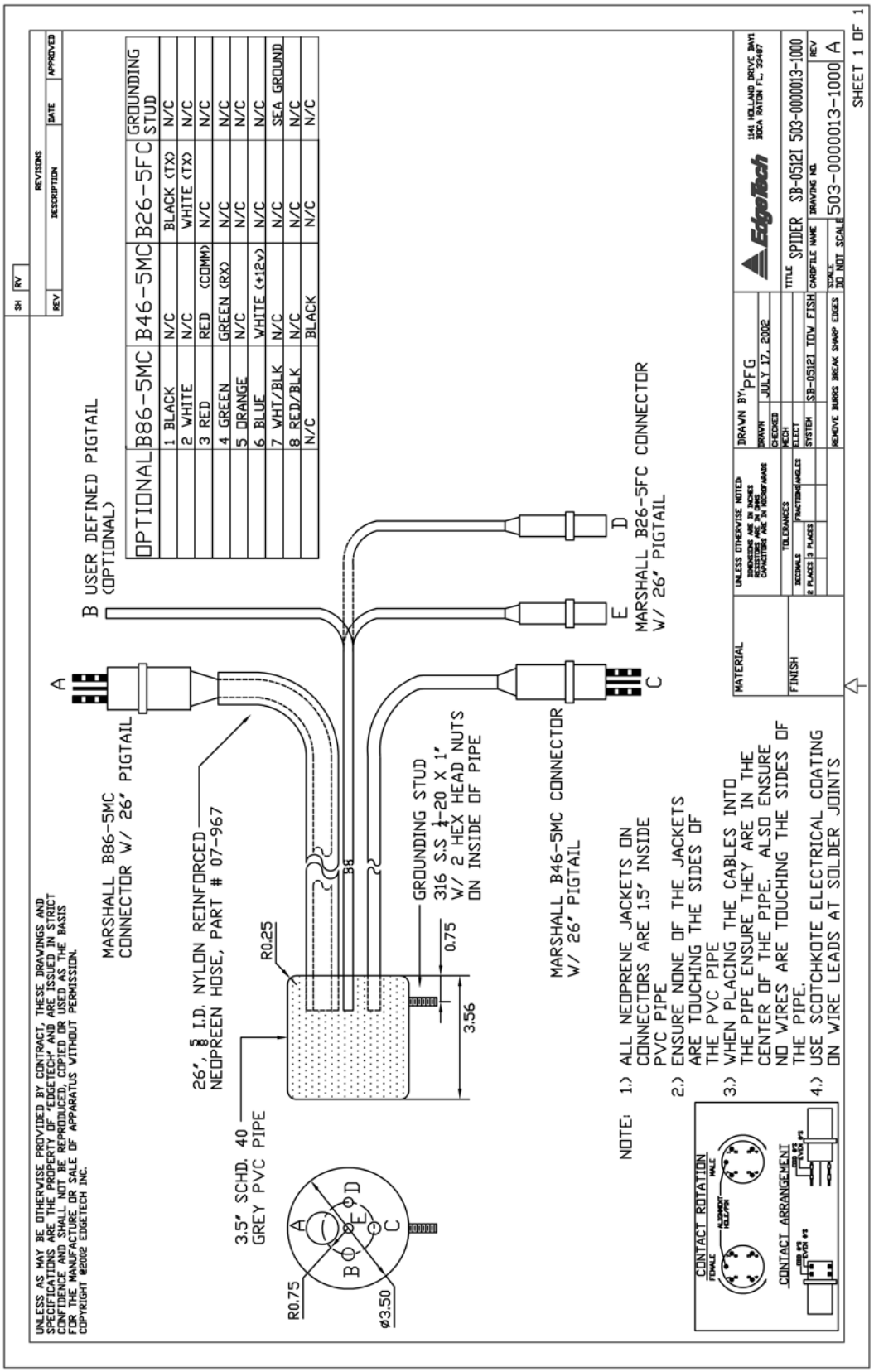
SH RV
REVISIONS
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COPYRIGHT ©2002 EDGETECH INC.
B USER DEFINED PIGTAIL (OPTIONAL)
OPTIONAL B86-5MC B46-5MC B26-5FC GROUNDING STUD
1 BLACK N/C BLACK (TX) N/C
2 WHITE N/C WHITE (TX) N/C
3 RED RED (COMM) N/C N/C
4 GREEN GREEN (RX) N/C N/C
5 ORANGE N/C N/C N/C
6 BLUE WHITE (+12v) N/C N/C
7 WHT/BLK N/C N/C SEA GROUND
8 RED/BLK N/C N/C N/C
N/C BLACK N/C N/C
A
MARSHALL B86-5MC CONNECTOR W/ 26' PIGTAIL
D
E
MARSHALL B26-5FC CONNECTOR W/ 26' PIGTAIL
C
MARSHALL B46-5MC CONNECTOR W/ 26' PIGTAIL
26', 5/8 I.D. NYLON REINFORCED NEOPREEN HOSE, PART # 07-967
R0.25
3.5' SCHD. 40 GREY PVC PIPE
GROUNDING STUD 316 S.S 1/4-20 X 1' W/ 2 HEX HEAD NUTS ON INSIDE OF PIPE
0.75
3.56
R0.75
ø3.50
NOTE: 1.) ALL NEOPRENE JACKETS ON CONNECTORS ARE 1.5' INSIDE PVC PIPE
2.) ENSURE NONE OF THE JACKETS ARE TOUCHING THE SIDES OF THE PVC PIPE
3.) WHEN PLACING THE CABLES INTO THE PIPE ENSURE THEY ARE IN THE CENTER OF THE PIPE. ALSO ENSURE NO WIRES ARE TOUCHING THE SIDES OF THE PIPE.
4.) USE SCOTCHKOTE ELECTRICAL COATING ON WIRE LEADS AT SOLDER JOINTS
CONTACT ROTATION
CONTACT ARRANGEMENT
MATERIAL
FINISH
UNLESS OTHERWISE NOTED
DRAWN BY PFG
DRAWN JULY 17, 2002
CHECKED
MECH
ELECT
SYSTEM SB-05121 TOW_FISH
REMOVE BURRS BREAK SHARP EDGES
TOLERANCES
DECIMALS
2 PLACES ± 3 PLACES ±
FRACTIONS ANGLES
EdgeTech
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503-0000013-1000 A
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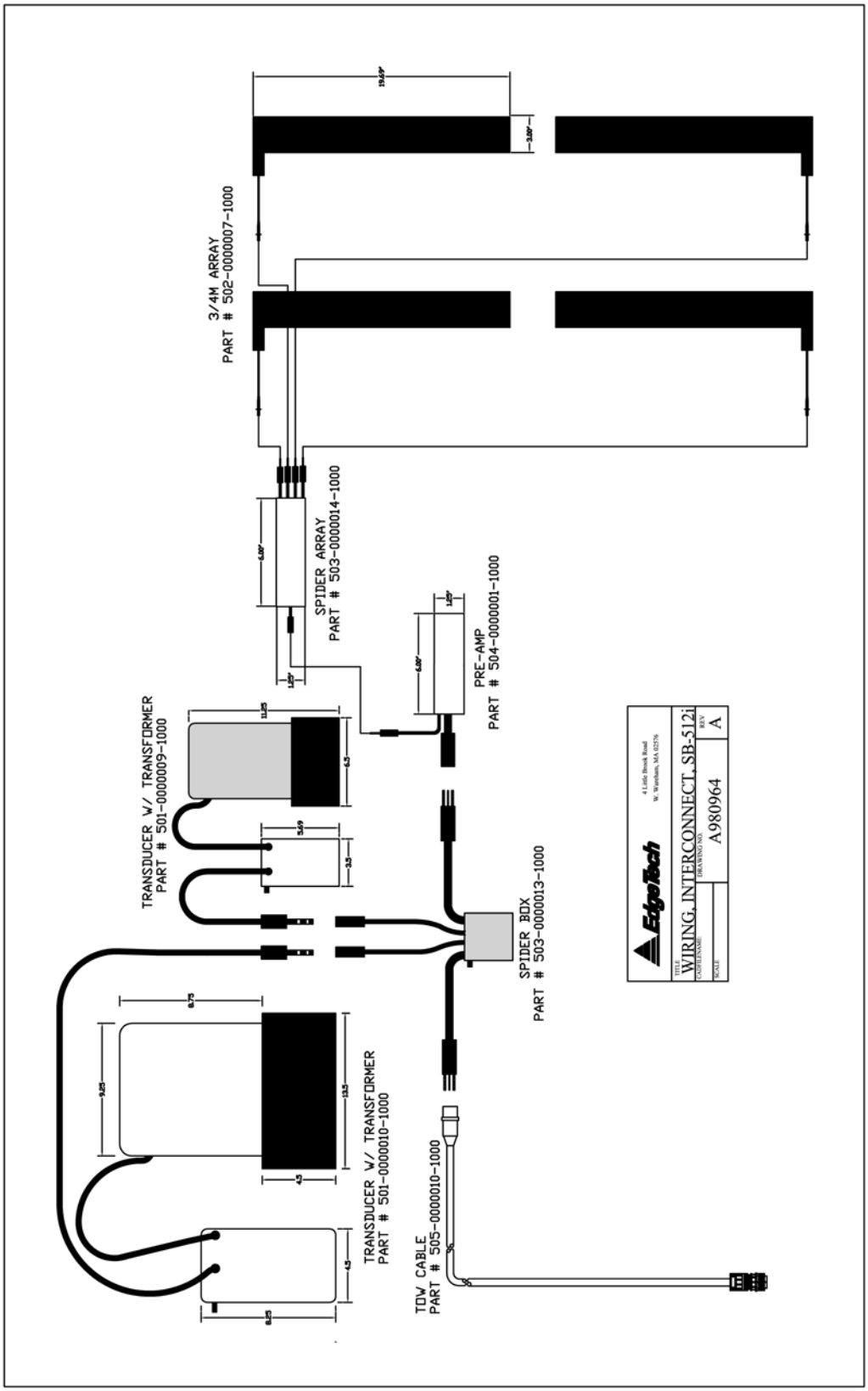
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SPIDER ARRAY
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PRE-AMP
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TRANSDUCER W/ TRANSFORMER
PART # 501-0000009-1000
SPIDER BOX
PART # 503-0000013-1000
TRANSDUCER W/ TRANSFORMER
PART # 501-0000010-1000
TDW CABLE
PART # 505-0000010-1000
EdgeTech
WIRING, INTERCONNECT, SB-512i
A980964
A

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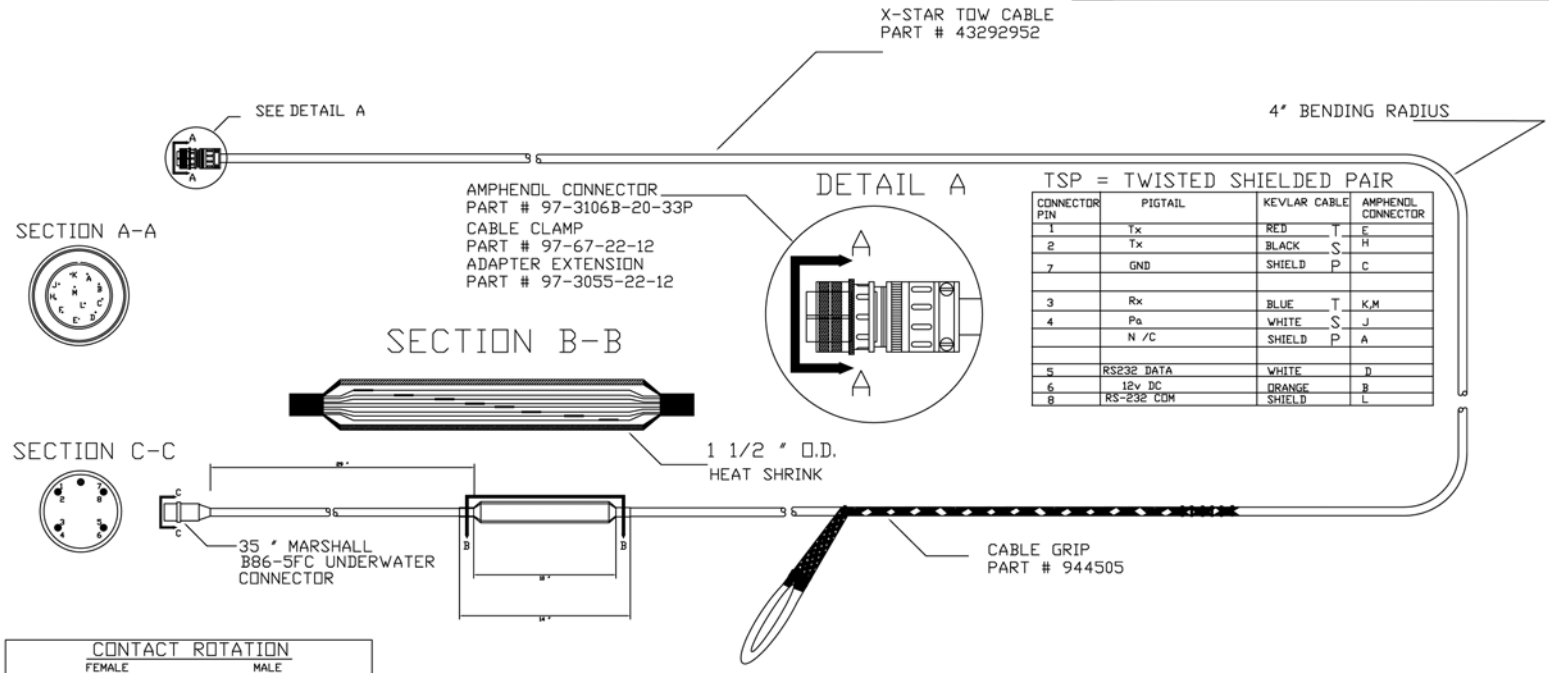
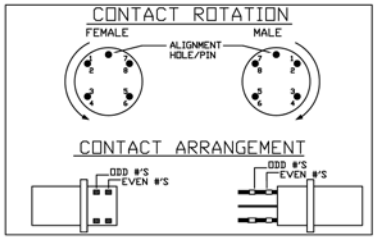


TSP = TWISTED SHIELDED PAIR

CONNECTOR PIN	PIGTAIL	KEVLAR CABLE		AMPHENOL CONNECTOR
1	Tx	RED	T	E
2	Tx	BLACK	S	H
7	GND	SHIELD	P	C
3	Rx	BLUE	T	K,M
4	Pa	WHITE	S	J
	N /C	SHIELD	P	A
5	RS232 DATA	WHITE		D
6	12v DC	ORANGE		B
8	RS-232 COM	SHIELD		L



MATERIAL	UNLESS OTHERWISE NOTED: DIMENSIONS ARE IN INCHES RESISTORS ARE IN OHMS CAPACITORS ARE IN MICROFARADS	DRAWN BY: P.F.G.	EdgeTech 1141 HOLLAND DRIVE BAY1 BOCA RATON FL, 33487
FINISH	TOLERANCES: DECIMALS 2 PLACES 3 PLACES; FRACTIONS; ANGLES	DRAWN APRIL 19 ,2002; CHECKED; MECH; ELECT; SYSTEM X-STAR RS-232	TITLE X-STAR TOW CABLE, RS-232
	REMOVE BURRS BREAK SHARP EDGES		CARDFILE NAME; DRAWING NO. 505-0000010-1000; REV B
			SCALE DO NOT SCALE; SHEET 1 OF 1

APPENDIX A: Printer Connections

A number of different printers are available for connecting to the 3200-XS Sub-Bottom Profiling System. All of these printers connect to the PARALLEL port connector on the back of the Deck Unit (see “Deck Unit Connections” on page 3-7).

Of the available printers, the following are recommended for best results:

- Ultra 120 (and HD version)
- Ultra 200 (and HD version)
- EPC HSP 100
- EPC 1086-NT
- EPC 1086
- EPC 1086 (early models)
- EPC 9206
- TDU-850
- Sys V8.5
- GeoPrinter 975

Of the available printers, the following are recommended for best results:

- EPC Model 1086
- EPC Model HSP-100
- Raytheon Model TDU-850

Listed in Table A-1 are the required settings to properly interface a printer with the 3200-XS Sub-Bottom Profiling System.

Table A-1: Printer Setting Requirements

Trigger:	Internal
Data input:	Parallel
Sweep:	Forward
LPI:	200
Width:	2048
Data type:	6 bits
Shades:	64
Image:	Positive
Contrast:	40%

A.1 EPC Model 1086

The EPC Model GSP-1086 is a gray scale continuous printer that is widely used in the marine industry. It provides high quality images on a ten-inch thermal printhead. The general specifications for the Model 1086 printer are listed in Table A-2.

Table A-2: EPC Model 1086 General Specifications

Paper:	Thermal or plastic
Data pixels:	2048
Paper length:	45.7 m (150 ft)
Film length:	39.6 m (130 ft)
Paper/film width:	26.6 cm (10.48 in.)
Resolution:	8 dots/mm (203 dots/in.)
Tone shades:	Up to 256 gray scale
Interface:	8 bit parallel
Plot speed:	43 ms per line @ 64 shades

A.2 EPC Model HSP-100

The EPC Model HSP-100 is a fast, high resolution, low cost thermal printer. The general specifications for the Model HSP-100 printer are listed in Table A-3.

Table A-3: EPC Model HSP-100 General Specifications

Paper:	Thermal or plastic
Data pixels:	2048
Paper length:	45.7 m (150 ft)
Film length:	39.6 m (130 ft)
Paper/film width:	25.6 cm (10.0 in.)
Resolution:	8 dots/mm (203 dots/in.)
Tone shades:	Up to 256 gray scale
Interface:	8 bit parallel
Plot speed:	10 ms per line maximum

A.3 Raytheon Model TDU-850

The Raytheon Model TDU-850 printer is a high speed gray shade printer that uses a fixed thermal head to produce a hard copy image on direct recording thermal paper. The general specifications for the Model TDU-850 printer are listed in Table A-4.

Table A-4: Raytheon Model TDU-850 General Specifications

Paper width:	22.2 cm (8.75 in.)
Active scan length:	21.6 cm (8.5 in.)
Paper roll length:	61 m (165 ft)
Resolution:	8 dots/mm (203 dots/in.)
Contrast:	23 dB minimum dynamic range
Sweep speed:	256 gray shades at 40 ms/line
Plot speed:	10 ms per line maximum

APPENDIX B: Frequently Asked Questions

Below are some frequently asked questions about the 3200-XS Sub-Bottom Profiling System. They encompass most of the questions asked by EdgeTech customers; however, should other questions arise, please contact EdgeTech directly. For contact information refer to “Customer Service” on page x.

1. What are the tow vehicle tow cable requirements?

   The tow cable must include three shielded twisted wire pairs. One set must be 18-gauge wire and is used for the transmitted signal. The other two sets must be 20-gauge wire and are used for the received signal, 12 VDC, common, and a spare.

2. Can a Rochester 301301 (3 core coax) armored cable be used?

   A 500-meter maximum length armored cable can be used. Contact EdgeTech for the wiring recommendation.

3. Can you interface a 3200-XS Sub-Bottom Profiling System to a transmit/receive hull mounted array that is customer supplied?

   This can be done; however, special engineering and calibration is required for optimum results. EdgeTech can provide these services. Basically, the output impedance of the Power Amplifier in the Deck Unit must match the input impedance of the transducer array. This match will maximize the power to the transducers, otherwise power will be lost in the amplifier instead of being output to the transducers. Matching is done with a transformer with the correct turns ratio. In addition, a hydrophone has to be temporarily placed below the transmitting transducers so that the system can be calibrated. Based on the calibration information, the system can be tuned in such a manner as to flatten the spectrum to improve the resolution of the records.

4. How long a tow cable can I use?

   Up to a 500-meter factory approved tow cable can be used.

5. How close to the bottom do I need to tow?

   Unlike side scan sonar, it is not always necessary to tow the tow vehicle near the sea floor to get good results. Depending on which tow vehicle is used, it is possible to get good results with hundreds of meters of water column. Towing the tow vehicle close to the bottom reduces the area of the sea floor insonified and therefore reduces the scattering. A focused, narrow beam also produces better spatial resolution.

6. How does the 3200-XS Sub-Bottom Profiling System interface to a navigation device?

   The COM 1-NAV or the COM3 RS-232 serial port can be used to interface with a navigation device.

7. How do the environmental conditions affect the performance of the 3200-XS Sub-Bottom Profiling System?

   There are several environmental factors that affect performance:

   Geological conditions—The 3200-XS Sub-Bottom Profiling System operating parameters and listed specifications are greatly affected by the geologic conditions that the acoustic energy transmitted from the tow vehicle encounters. A very dense geologic interface, such as rock, coral, sand, stone, shell beds, and so on, will limit the sound penetration into the sub-bottom. This limitation is caused by the density interface reflecting most, if not all, normal incidence acoustic energy back to the receiving hydrophone which results in little penetration.

   Air/water interface— The air/water interface reflects 99.8 percent of the acoustic energy it receives. Therefore when air or gas is encountered in the water column or in the sub-bottom, almost all of the transmitted acoustic energy will be reflected back to the tow vehicle resulting in little or no penetration into the seabed.

   Survey vessel's wake—The ship's wake is a very turbulent area that is located immediately behind the ship. When towing the tow vehicle in or near this wake, the transmitted acoustic energy encounters highly charged aerated water caused by the cavitation of the ship's propellers. If the tow vehicle is operated in this area, most of the acoustic energy from the aerated water is reflected back to its source, similar to that exhibited by an air/water interface. The tow vehicle is designed to operate in a horizontal position relative to the sea floor. The turbulence encountered when operated in or near the ship's wake will cause instability in the tow vehicle and reduce the effectiveness of the output energy in penetrating the sub-bottom sediments.

   Noise—Operating other nearby acoustic devices at frequencies within the operating frequency bandwidth of the 3200-XS Sub-Bottom Profiling System can result in data distortion.

   Survey vessel's motion—The tow vehicle is designed to tow in a stable horizontal plane. Excessive ship motion can cause instability in the tow vehicle attitude resulting in reduced performance. Rough sea conditions, sharp turns of the ship and any similar external induced motions on the tow vehicle will have a similar effect on the system operation.